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Oceanographic Observations made during a Cooperative Survey of Albacore (Thunnus Germo) off the North American West Coast in 1959

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FISH AND WILDLIFE SERVICE

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United States Department of the Interior, Stewart L. Udall, Secretary
Fish and Wildlife Service, Clarence F. Pautzke, Commissioner
Bureau of Commercial Fisheries, Donald L. McKernan, Director

OCEANOGRAPHIC OBSERVATIONS MADE DURING A COOPERATIVE SURVEY OF ALBACORE (THUNNUS GERMO) OFF THE NORTH AMERICAN WEST COAST IN 1959

By

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ABSTRACT

This report lists the physical, chemical, and biological data collected by scientists aboard the Hugh M. Smith of the Bureau of Commercial Fisheries and N. B. Scofield of the California Department of Fish and Game during the spring and early summer of 1959 off the coast of California and Baja California, Mexico. The purpose of the cruises was to locate the route of the spring migration of albacore into west coast waters and the subsequent early concentrations of these fish.

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The North American west coast fishery for albacore, Thunnus germo (Lacépède), usually extends from central Baja California, Mexico, to central California, but at times it has extended as far north as Queen Charlotte Island, Canada. The fishery begins during the spring and early summer off the coast of Baja California and southern California and reaches its peak there around August (Clemens, 1955). In the late summer and fall, the fishery shifts northward to central California and during some years develops off the coasts of Oregon and Washington (Powell et al., 1952). By winter, fishing is usually ended, although in some years a small winter fishery develops (Pacific Fisherman, 1956; California Department of Fish and Game, 1949).

The success of the summer fishery in any given year depends in part on how readily the commercial fishermen are able to locate concentrations of fish early in the season. With this in mind, a cooperative preseason survey of the west coast albacore fishing grounds was conducted in 1959 by the Bureau of Commercial Fisheries Biological Laboratory, Honolulu, Hawaii, and the California Department of Fish and Game. The intention was to locate the migration route of albacore into west coast waters and the areas of commercial concentration. This paper presents the meteorological, physical oceanographic, and biological data obtained and describes the methods used to collect them. Exploratory fishing results are the subject of another report (Craig and Graham, 1961).

ITINERARY

Cruise 52 of the Bureau of Commercial Fisheries vessel Hugh M. Smith and cruise 59S4 of the California Department of Fish and Game vessel N. B. Scofield covered areas off California and northern Baja California. The cruise tracks for the two vessels are shown in figures 1 and 2. The Hugh M. Smith (fig. 1) departed Honolulu on April 28 and proceeded to Point A (39° N., 135° W.). After reaching this point the cruise was interrupted on May 11 because of illness of a crewman, who was taken to San Francisco. On May 17 the cruise was resumed at the point where it had been interrupted. Because of the loss of time during the emergency run to San Francisco, a series of stations planned for the track between point D (27° N., 118° 30' W.) and San Diego was omitted. The Smith arrived at San Diego on May 27. The second portion of the survey (fig. 1, bottom panel) was begun on May 30 and was completed on June 19.

The Scofield departed Los Angeles harbor on June 1. After a brief stopover at Santa Barbara to obtain certain scientific equipment, the Scofield proceeded along the track shown in figure 2. The cruise was completed on June 25.

METEOROLOGICAL OBSERVATIONS

Marine weather observations were recorded daily by scientists aboard the Smith at 0000, 0600, 1200, and 1800 GCT and were transmitted daily to the U. S. Weather Bureau (table 1). Standard weather data were entered in the bathythermograph logs aboard both vessels (tables 2 and 3).

One storm, with maximum wind velocities of force 7, occurred within the 48-day cruise period of the Smith. During 10 percent of the

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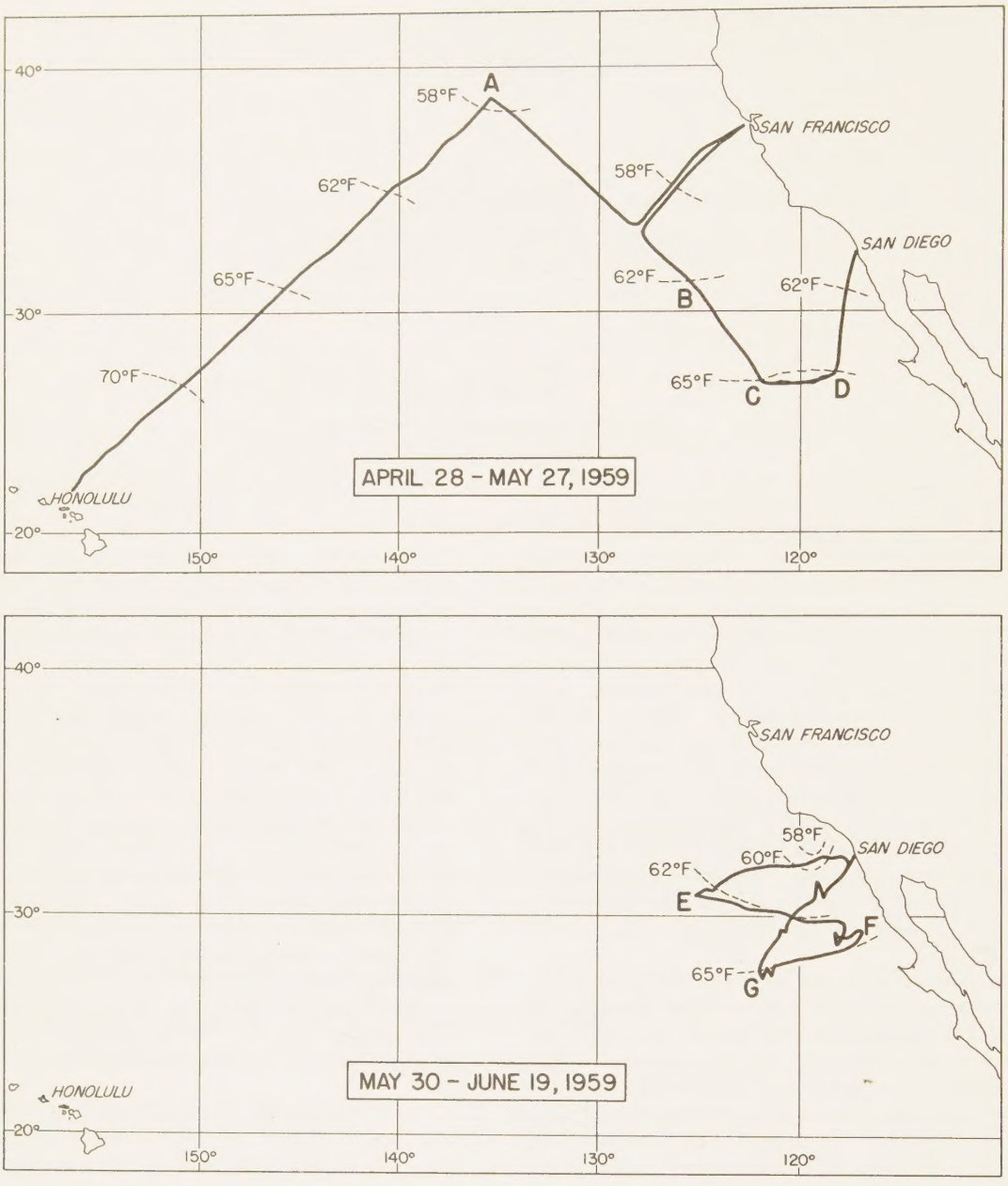


Figure 1.--Track of Hugh M. Smith cruise 52.

cruise period the winds exceeded force 5. In contrast, winds exceeding force 5 were recorded for 60 percent of the 21-day Scofield cruise; winds reached a maximum of force 8.

PHYSICAL AND CHEMICAL OBSERVATIONS

Temperatures

Bathythermograph casts were made to 900 feet at intervals of 30 to 60 miles along the cruise track of the Smith, and in addition a 900-foot and a 400- or 200-foot cast were made on all fishing stations. Casts to 400 feet were made from the Scofield approximately every 20 to 90 miles. The bathythermograph logs are reproduced in tables 2 and 3. The vertical temperature sections with accompanying bucket temperatures are shown in figures 3 and 4. The plots are based on BT slides processed at the Bureau

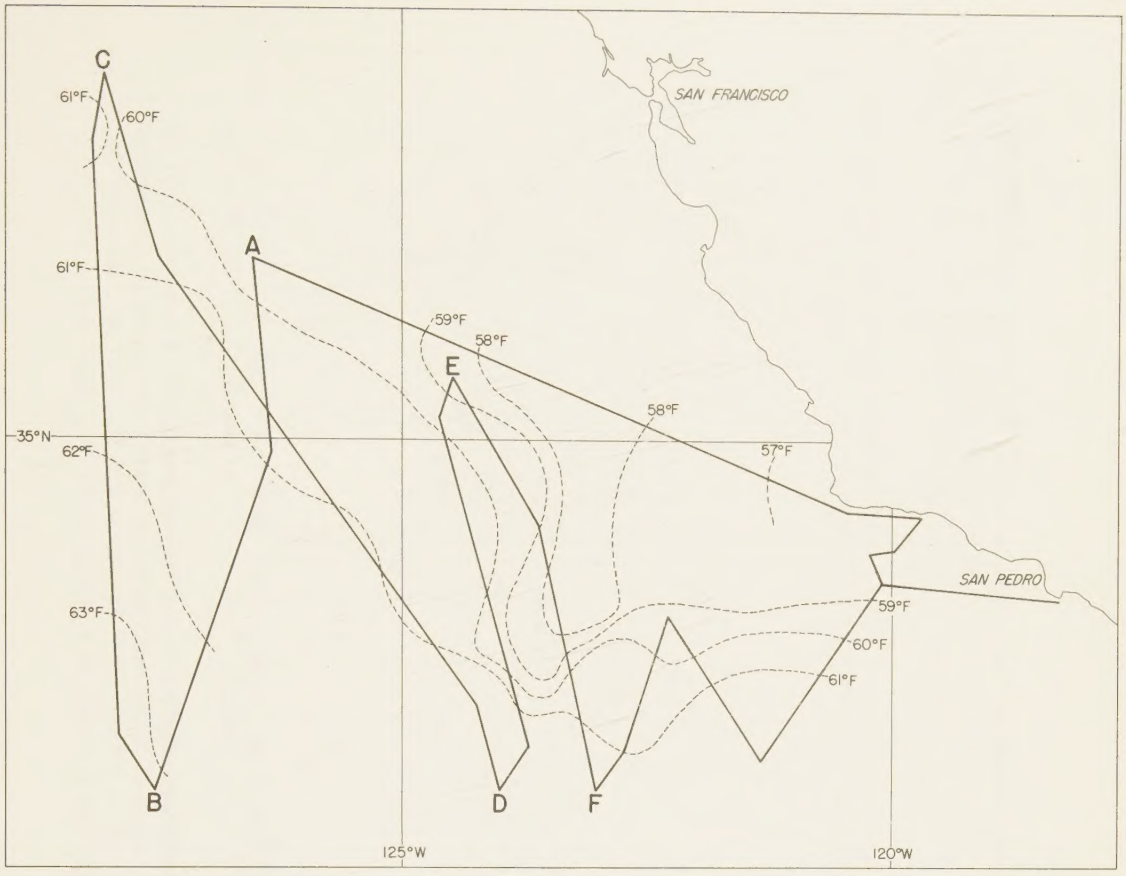


Figure 2.--Track of N. B. Scofield cruise 59S4.

of Commercial Fisheries Biological Laboratory, Honolulu, using methods described by Callaway (1957).

Continuous records of surface temperature were obtained along the cruise tracks of both vessels by means of recording thermographs.

Light Penetration and Water Color

Light penetration measurements were made from the Smith with a photometer and a Secchi disc, and water color was determined with a Forel color scale. Secchi disc measurements were also made from the Scofield. By means of the photometer, described by Callaway (1957), we determined the depths to which 50 percent, 10 percent, 5 percent, and 1 percent of sunlight were transmitted. Usually these measurements were made at noon (LCT). In a few instances observations were made from the Smith during the morning hours, but they were discontinued because it was found that there was insufficient sunlight to produce reliable readings. Light penetration and water color data and the average illumination on deck are given in tables 4 and 5.

Salinity and Inorganic Phosphate

Surface salinity samples were collected coincident with each BT cast from both the Smith and Scofield. Samples were also obtained from the Smith fishing stations. Surface water samples, frozen for subsequent analysis of their inorganic phosphate content, were obtained from the Scofield with each BT cast. On the Smith, samples for phosphate analysis were collected at BT casts at approximately 90-mile intervals between Oahu and point B (32° N., 127° 30' W.), and at 30-mile intervals east of point B; they were also collected at every fishing station. All salinity and inorganic phosphate samples were analyzed at the Bureau of Commercial Fisheries Biological Laboratory, Honolulu. Salinity samples were processed using a modification of the Mohr method (Van Landingham, 1957) and inorganic phosphate by a modification of the molybdenum method using the Beckman Photometer Model B (King et al., 1957). The data taken

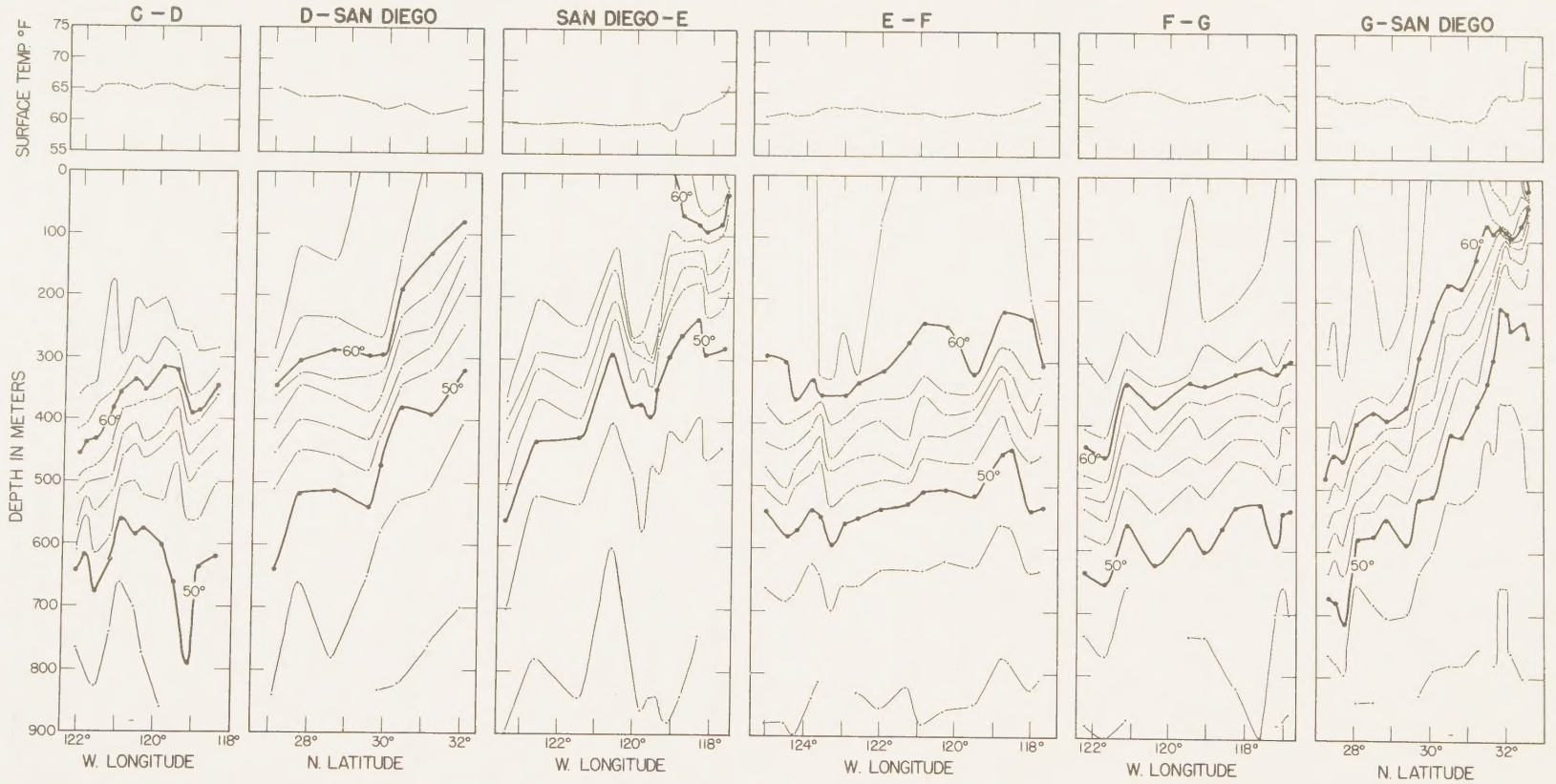
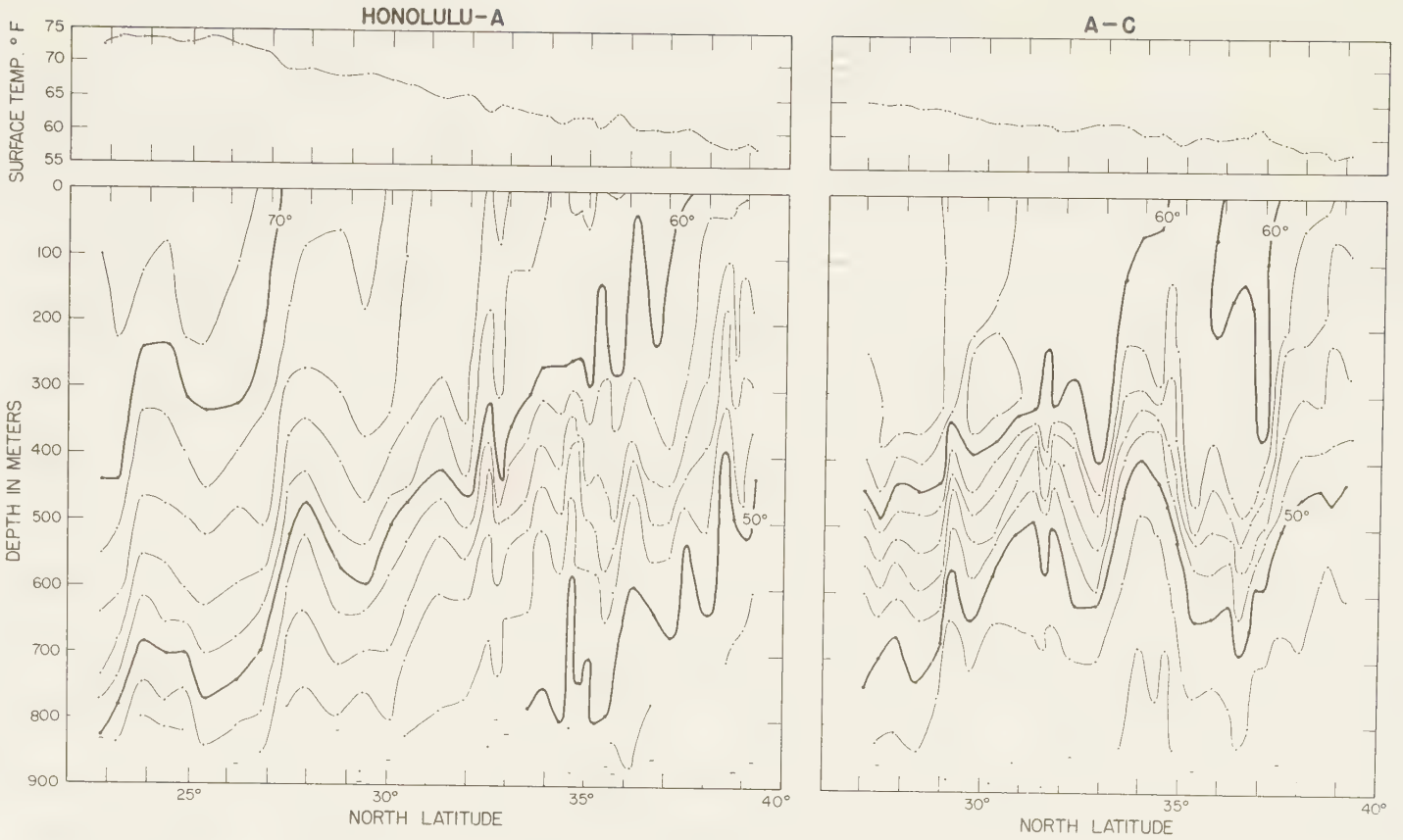


Figure 3.--Surface temperature (upper panel) and temperature-depth profiles (lower panel) for successive legs of Hugh M. Smith cruise 52. For general location of legs, see the track chart. Positions of designated points of the legs are: A -- 39° N., 135° W.; B -- 31° N., 125° W.; C -- 27° N., 122° W.; D -- 27° N., 110° 30' W.; E -- 31° N., 125° W.; F -- 29° 30' N., 118° W.; and G -- 27° N., 122° W.



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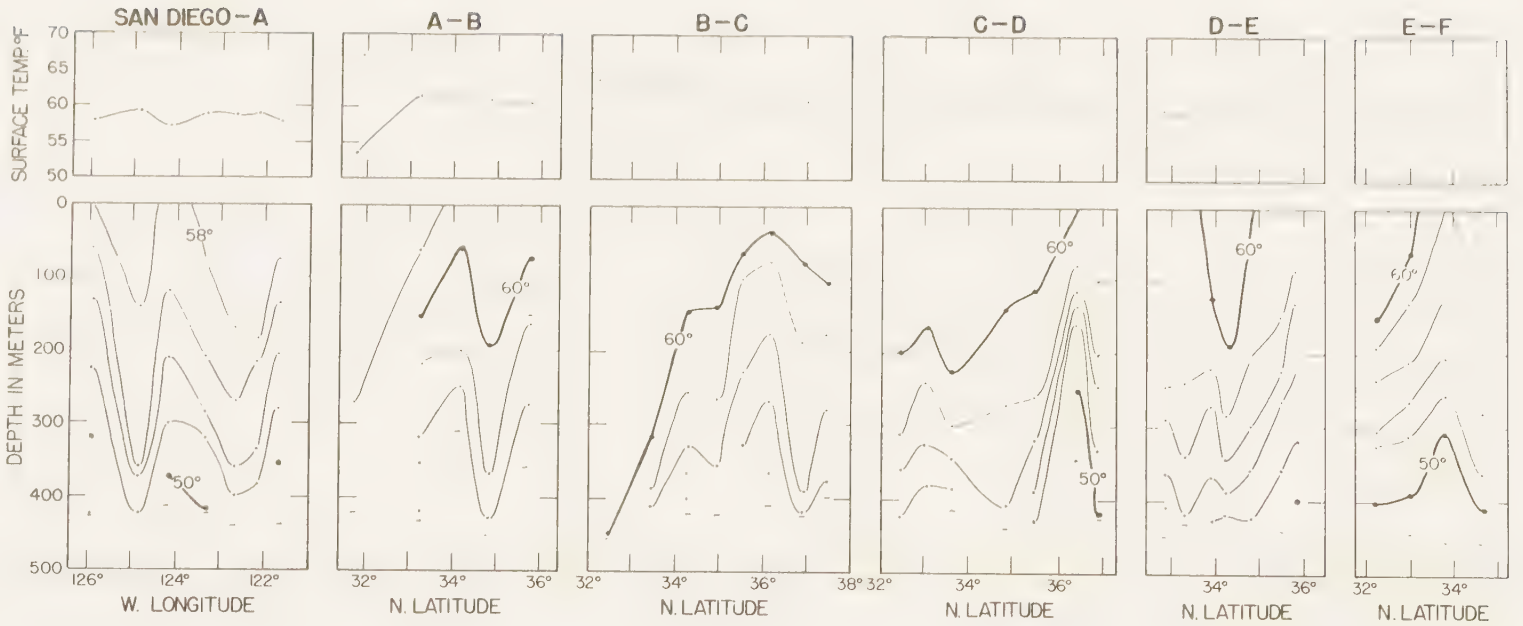

Figure 4.--Surface temperature (upper panel) and temperature-depth profiles (lower panel) for successive legs of N. B. Scofield cruise 59S4. For general location of legs, see the track chart. Positions of designated points of the legs are: A -- 36° 30' N., 126° 30' W.; B -- 32° N., 127° 30' W.; C -- 38° N., 128° W.; D -- 32° N., 124° W.; E -- 35° 30' N., 124° 30' W.; and F -- 32° N., 123° W.

coincidentally with stations are given in tables 4 and 5; those associated with BT lowerings while under way are listed in tables 2 and 3.

BIOLOGICAL OBSERVATIONS

Isotopic Carbon (C_{14}) Primary Productivity Samples

Surface water samples for the analysis of C_{14} uptake by phytoplankton were collected by scientists of both vessels with a clean plastic bucket. They were then transferred to one "dark" and two "light" bottles, inoculated with radioactive sodium carbonate solution and incubated in an illuminated water bath. The details followed in these procedures were those described by King et al. (1957). Collections were made around noon from both vessels. In a few instances some were made at other times when abrupt changes in temperature, light penetration, or other environmental entities occurred. The carbon fixation measurements and calculations of the rate of carbon fixation (tables 4 and 5) were made using techniques developed by Steemann Nielsen (1952) and modified by Doty and Oguri (1958).

Zooplankton Collections

Night surface tows were made from the Smith for a period of 20 minutes with a 1-meter plankton net. Similar tows were made at dusk from the Scofield. The net towed from the Smith was constructed of Nitex and had a mesh aperture of 0.656 mm. The amount of water strained was metered with an Atlas flow meter which had been calibrated at the time of the Smith's departure from Honolulu. The net used on the Scofield was on loan from the Bureau of Commercial Fisheries Biological Laboratory, La Jolla, and was described as a 1-meter net having an anterior portion of 30XXX grit gauze, Dufour bolting cloth (silk) and a posterior portion and cod end of 56XXX grit gauze. Aperture size (mode) of these two portions was 0.0278 inches and 0.0125 inches, respectively. The Japanese flow meter used was calibrated after the cruise. All plankton samples were preserved in 10-percent formalin buffered with borax and returned to the Bureau of Commercial Fisheries Biological Laboratory, Honolulu. The wet drained weight was determined for each sample and entered in tables 4 and 5 in terms of grams per 1,000 cubic meters of water strained.

Night-light Observations

Night-light observations were made from both the Smith and the Scofield. Observations from the Smith were for a period of 1 hour using as illumination the overside lights and the stern deck light. The Scofield was equipped with a 1,500-watt bulb with a reflector suspended 3 to 4 feet above the water. A single station was occupied by the Scofield for a period of 2 1/2 hours; other stations were planned but omitted because of the necessity to maintain headway against high seas. Data obtained by the two vessels are shown in tables 4 and 5.

Occurrence of Fish, Birds, and Aquatic Mammals

Wheel watches of the Smith maintained logs of fish, birds, and aquatic mammals sighted during daylight hours. Similar observations were made from the Scofield and recorded in the scientists' log. These observations are tabulated in tables 6 and 7.

MISCELLANEOUS OBSERVATIONS

Miscellaneous observations were made by scientists aboard the Smith as follows: (1) A collection of shark intervertebral tissue was made for Dr. Karl Meyer of Columbia University, New York. (2) Blood serum was extracted for racial studies from two bigeye tuna, Parathunnus sibi (Temminck and Schlegel), and one skipjack tuna, Katsuwonus pelamis (Linnaeus), for the Bureau of Commercial Fisheries Biological Laboratory, Seattle, Washington. (3) A small net was placed in the rigging of the ship, and the removable cod end was changed at noon for 19 days in an effort to capture airborne insects for the Bishop Museum of Honolulu, Hawaii. (4) Fifteen times during the cruise of the Smith C_{14} samples were incubated by towing them astern in a manner requested by Dr. M. S. Doty of the University of Hawaii at Honolulu, Hawaii.

ACKNOWLEDGMENTS

Field Party Personnel:

Hugh M. Smith

Robert E. K. D. Lee - Master
Joseph J. Graham - Field Party Chief
Murice O. Rinkel - Oceanographer
Richard N. Uchida - Fishery Research Biologist

N. B. Scofield

Richard B. Mitchell - Master
William L. Craig - Field Party Chief
Donald A. Carvalho - Assistant

We wish to thank the captains and crews of the Hugh M. Smith and N. B. Scofield for their cooperation during the survey. The crew of the Scofield collected data under particularly trying weather conditions. We also wish to acknowledge the assistance extended to the field party of the Smith during her stay in the port of San Diego by staff members of the Bureau of Commercial Fisheries Biological Laboratories at San Diego and La Jolla, California.

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Table 1.--Summary of weather observations (USWB 1210-F), Hugh M. Smith cruise 52

Date, 1959	Latitude N.	Longitude W.	Time (GCT)	Visibility	Wind		Weather		Pressure			Temperature (° F.)			Clouds						Waves		
					Direction	Speed (kn.)	Present	Past	Bar. cor. (mb.)	Characteristic	Amt. change	Dry bulb	Wet bulb	Sea water	Total amount	Amount low	Type low	Height low	Type middle	Type high	Direction	Period	Height
4/29	22.3°	156.6°	1200	99	09	18	02	2	1020.7	7	0.6	73.4	68.0	73.7	6	7	1	5	4	0	08	2	3
4/29	22.8°	156.0°	1800	98	11	19	95	8	1022.0	2	1.4	71.2	68.7	72.2	6	6	7	5	0	0	11	2	3
4/30	23.3°	155.3°	0000	98	12	17	01	1	1019.6	0	1.8	76.8	69.4	73.1	2	2	2	5	0	0	10	4	2
4/30	23.8°	154.7°	0600	98	08	15	02	0	1021.0	2	2.0	73.0	68.8	73.5	1	1	9	5	0	0	08	4	3
4/30	24.4°	153.9°	1200	98	11	16	02	0	1021.0	8	1.0	72.2	67.5	73.1	1	1	1	5	0	0	10	3	2
4/30	25.0°	153.2°	1800	98	10	16	25	8	1021.7	3	1.0	73.7	66.4	72.7	2	2	9	5	0	0	10	3	2
5/1	25.6°	152.5°	0000	98	11	14	02	0	1020.7	7	1.2	73.7	66.8	73.2	1	1	2	5	0	0	10	2	2
5/1	26.2°	151.8°	0600	98	10	14	02	0	1021.7	3	1.1	72.4	65.2	72.2	1	1	9	5	0	0	06	2	2
5/1	26.8°	151.0°	1200	98	11	09	02	0	1021.5	7	0.6	71.5	67.8	71.2	1	1	1	5	0	0	10	2	2
5/1	27.4°	150.3°	1800	98	11	17	15	8	1022.4	2	1.0	70.4	65.0	68.8	6	6	8	5	0	0	10	4	3
5/2	28.0°	149.5°	0000	98	09	12	01	1	1022.4	8	0.6	70.1	63.2	68.8	2	1	8	5	0	5	10	4	3
5/2	28.7°	148.8°	0600	98	09	15	02	0	1024.4	3	2.0	69.0	61.8	68.0	2	2	1	5	0	0	10	4	2
5/2	29.3°	148.0°	1200	98	11	14	00	X	1024.4	7	1.0	66.9	59.7	67.7	X	X	X	X	X	X	10	3	2
5/2	29.9°	147.2°	1800	98	12	14	03	1	1027.1	2	1.4	66.7	59.3	67.1	7	7	5	5	0	0	12	2	2
5/3	30.5°	146.5°	0000	98	12	11	01	1	1026.4	8	0.7	66.0	57.6	65.1	3	1	1	5	0	4	02	4	2
5/3	31.1°	145.7°	0600	98	10	13	02	0	1027.8	3	1.2	64.7	57.8	64.9	4	1	1	5	0	5	02	4	1
5/3	31.8°	144.8°	1200	98	11	12	03	1	1027.4	8	0.9	63.8	57.4	65.2	5	2	1	5	0	6	06	2	1
5/3	32.4°	144.0°	1800	98	14	10	03	2	1029.1	3	1.7	63.4	55.6	63.4	7	2	1	5	0	6	10	2	1
5/4	32.8°	143.4°	0000	98	15	11	01	2	1029.1	7	1.4	64.8	57.5	63.8	4	1	1	5	0	5	05	4	1
5/4	33.3°	142.8°	0600	98	16	10	02	2	1029.8	3	0.8	63.0	57.2	62.7	4	2	1	5	0	5	04	4	1
5/4	33.7°	142.2°	1200	98	16	12	01	1	1028.1	8	1.5	61.8	56.3	61.7	1	1	5	5	0	1	15	2	0
5/4	34.1°	141.6°	1800	98	18	11	03	0	1029.1	3	1.2	62.6	56.8	61.4	3	1	4	5	0	4	02	3	1
5/5	34.6°	141.0°	0000	98	23	10	02	1	1029.1	8	0.2	64.2	58.0	62.3	7	1	5	5	0	7	22	2	1
5/5	34.8°	140.7°	0600	98	21	09	03	2	1029.8	3	0.9	64.3	58.0	62.0	8	2	5	5	0	7	22	2	1
5/5	34.7°	140.9°	1200	98	22	10	01	1	1029.1	6	0.8	62.6	58.2	61.8	0	0	0	9	0	0	25	2	1
5/5	35.0°	140.5°	1800	98	25	07	03	0	1030.8	3	1.4	62.7	59.5	61.0	1	1	4	5	0	5	29	5	0
5/6	35.5°	139.9°	0000	98	24	06	03	0	1030.8	8	0.2	65.4	60.4	62.9	2	1	2	5	1	5	29	4	1
5/6	35.9°	139.2°	0600	98	24	06	03	0	1031.8	3	0.8	61.3	59.8	60.8	3	1	2	5	0	5	29	+	1
5/6	36.4°	138.6°	1200	98	23	03	01	0	1031.2	6	0.6	60.4	59.6	60.6	1	1	X	X	X	X	XX	X	X
5/6	36.8°	138.0°	1800	98	26	03	03	0	1032.2	1	0.6	62.7	59.4	61.3	2	1	2	5	1	5	30	4	2

X - Not observed

Table 1.--Summary of weather observations (USWB 1210-F), Hugh M. Smith cruise 52 - con.

Date, 1959	Latitude N.	Longitude W.	Time (GCT)	Visibility	Wind		Weather		Pressure			Temperature (° F.)			Clouds						Waves		
					Direction	Speed (kn.)	Present	Past	Bar. cor. (mb.)	Characteristic	Amt. change	Dry bulb	Wet bulb	Sea water	Total amount	Amount low	Type low	Height low	Type middle	Type high	Direction	Period	Height
5/7	36.8°	138.1°	2300	98	25	07	03	0	1031.5	8	0.8	65.3	59.3	61.9	3	2	2	5	0	2	28	4	2
5/7	37.2°	137.5°	0600	98	23	06	02	0	1029.8	3	0.2	61.9	58.8	61.0	3	2	2	5	3	5	29	5	3
5/7	37.8°	136.8°	1200	98	23	09	02	0	1027.1	6	1.7	62.6	58.9	58.8	3	X	X	X	X	X	XX	X	X
5/7	38.3°	136.2°	1800	98	20	07	03	1	1026.8	7	0.2	62.4	59.8	58.1	7	6	3	5	7	5	28	5	3
5/8	38.7°	135.5°	0000	98	23	06	01	2	1025.7	7	1.0	64.7	60.2	58.6	6	1	2	6	7	6	28	5	3
5/8	38.9°	135.2°	0600	98	21	07	01	1	1026.8	3	0.7	59.9	58.0	57.7	2	2	X	X	X	X	28	5	2
5/8	38.8°	135.1°	1200	98	35	13	03	1	1027.8	2	0.2	58.8	56.8	57.4	8	8	X	X	X	X	29	2	1
5/8	38.7°	134.9°	1800	98	35	14	15	5	1032.2	2	2.4	57.8	53.7	57.0	7	7	7	4	0	0	35	2	1
5/9	38.3°	134.4°	0000	98	35	14	02	2	1032.5	0	0.0	57.6	52.7	58.0	7	7	5	4	0	0	35	2	2
5/9	37.8°	133.7°	0600	98	01	15	01	2	1033.2	3	0.7	56.6	51.2	58.25	6	2	5	4	0	6	33	2	3
5/9	37.3°	133.2°	1200	98	01	08	01	1	1031.2	7	1.0	55.8	50.6	59.4	3	2	5	4	0	5	XX	X	X
5/9	36.8°	132.6°	1800	98	36	14	03	2	1031.5	0	0.2	59.0	53.8	60.6	7	7	5	4	0	0	35	5	3
5/10	36.5°	132.2°	0000	98	36	12	02	2	1029.1	8	2.0	59.8	54.3	61.0	8	8	6	4	X	X	32	4	4
5/10	36.7°	132.4°	0600	97	36	14	50	5	1027.1	8	0.3	58.9	56.6	61.1	8	8	7	4	X	X	32	3	3
5/10	36.7°	132.4°	1200	97	01	09	50	5	1024.4	6	1.4	58.7	56.2	67.2	8	8	7	4	X	X	36	2	2
5/10	36.5°	132.2°	1800	98	06	09	02	5	1023.7	7	0.3	57.9	55.0	60.9	7	7	7	4	0	0	36	4	2
5/11	36.1°	131.5°	0000	98	05	12	02	2	1020.3	7	2.0	59.4	54.2	60.25	7	7	5	4	0	0	04	2	2
5/11	35.6°	131.0°	0600	98	07	12	01	1	1018.0	6	0.5	57.3	54.5	59.8	3	3	X	X	X	X	05	2	2
5/11	35.2°	130.4°	1200	98	04	12	01	0	1015.6	7	1.0	57.8	55.0	60.0	2	1	1	5	0	5	05	2	2
5/11	34.7°	129.7°	1800	98	04	14	02	0	1015.2	4	0.0	60.8	55.8	59.1	2	1	1	5	0	5	04	2	3
5/12	34.2°	129.1°	0000	98	04	14	02	0	1012.2	7	1.6	59.6	56.6	60.9	2	2	1	5	0	0	05	2	3
5/12	33.8°	128.6°	0600	98	07	08	03	0	1011.5	3	0.2	58.6	55.7	60.2	3	X	X	X	X	X	03	2	2
5/12	33.7°	127.9°	1200	98	32	06	03	1	1010.5	8	0.4	59.5	55.0	60.1	6	X	X	X	X	X	04	2	2
5/12	34.4°	127.1°	1800	98	05	10	03	2	1012.2	2	1.4	60.9	55.4	58.6	8	8	5	5	X	X	36	3	4
5/13	35.1°	126.3°	0000	98	20	12	01	2	1012.5	2	0.5	60.7	56.0	58.2	7	6	5	5	0	6	35	3	2
5/13	35.8°	125.5°	0600	98	18	12	03	2	1015.2	2	1.7	60.0	57.4	57.8	8	X	X	X	X	X	35	3	1
5/13	36.5°	124.4°	1200	98	18	09	01	1	1016.6	1	1.0	58.0	56.4	56.0	3	X	X	X	X	X	36	2	1
5/13	37.2°	123.4°	1800	98	14	11	03	1	1017.3	3	1.4	58.4	56.2	54.2	7	6	5	5	3	0	35	3	2
5/15	37.4°	123.0°	1800	98	32	28	02	0	1021.0	1	1.0	55.6	51.2	54.1	0	0	0	9	0	0	30	2	6
5/16	37.4°	123.6°	0000	98	33	28	02	0	1020.3	5	0.0	56.6	51.0	54.5	0	0	0	9	0	0	32	2	8

Table 1.--Summary of weather observations (USWB 1210-F), Hugh M. Smith cruise 52 - con.

Date, 1959	Latitude N.	Longitude W.	Time (GCT)	Visibility	Wind		Weather		Pressure			Temperature (° F.)			Clouds						Waves		
					Direction	Speed (kn.)	Present	Past	Bar. cor. (mb.)	Characteristic	Amt. change	Dry bulb	Wet bulb	Sea water	Total amount	Amount low	Type low	Height low	Type middle	Type high	Direction	Period	Height
5/16	37.3°	124.2°	0600	98	34	22	03	0	1021.0	3	0.7	55.6	51.9	53.0	3	0	0	9	0	5	32	3	6
5/16	36.6°	125.0°	1200	98	34	20	00	0	1020.7	7	0.2	56.3	52.7	58.2	1	1	8	4	0	0	32	3	4
5/16	36.0°	125.8°	1800	98	32	13	03	1	1021.7	3	1.2	57.8	54.1	57.1	6	1	1	5	0	6	32	3	3
5/17	35.2°	126.4°	0000	98	31	15	02	2	1021.7	6	0.5	61.6	56.2	59.6	6	2	2	5	0	6	32	3	2
5/17	34.4°	127.1°	0600	98	31	14	03	2	1021.7	3	0.8	61.3	56.9	59.2	7	0	0	9	0	7	31	3	2
5/17	33.7°	127.9°	1200	98	31	16	01	1	1021.0	6	0.3	61.3	57.8	61.0	0	0	0	9	0	0	31	3	2
5/17	33.3°	128.0°	1800	98	35	14	25	1	1023.4	2	2.0	62.0	59.8	61.0	7	7	9	4	0	0	31	3	2
5/18	33.3°	127.9°	0000	98	36	09	02	2	1023.7	7	0.3	65.8	55.7	61.9	6	2	0	5	5	6	31	4	3
5/18	32.8°	127.2°	0600	98	36	07	01	1	1024.4	3	0.7	61.6	56.8	61.5	1	1	1	5	0	0	36	4	3
5/18	32.1°	126.4°	1200	98	36	10	03	1	1022.4	6	1.0	59.9	55.1	60.9	7	X	X	X	X	X	36	4	2
5/18	31.6°	125.7°	1800	98	01	16	01	1	1024.4	1	0.8	62.0	56.0	61.2	2	2	1	5	0	0	34	4	4
5/19	31.2°	125.2°	0000	98	36	21	02	1	1022.4	7	1.5	61.3	56.2	62.0	6	3	3	5	6	0	35	3	5
5/19	30.7°	124.8°	0600	98	01	21	02	2	1022.4	2	0.9	60.6	53.7	61.8	6	6	8	5	0	0	02	3	4
5/19	30.2°	124.3°	1200	98	01	23	02	2	1020.3	7	1.0	60.2	54.9	62.0	5	5	8	5	0	0	02	3	5
5/19	29.6°	124.1°	1800	98	36	26	01	2	1021.7	2	0.7	63.8	58.0	62.9	4	5	3	5	0	0	02	4	8
5/20	29.1°	123.7°	0000	98	02	24	01	0	1019.0	8	1.2	63.6	58.7	63.5	4	3	2	5	0	0	36	4	7
5/20	28.9°	123.5°	0600	98	36	22	03	1	1019.3	3	0.3	62.9	57.8	64.0	7	7	8	5	0	0	36	4	6
5/20	29.4°	123.7°	1200	98	01	22	30	1	1018.6	7	0.6	61.6	58.7	63.2	3	2	7	5	0	6	36	4	6
5/20	29.6°	123.9°	1800	98	02	20	25	8	1020.3	1	1.0	63.3	58.7	63.4	7	7	3	4	0	0	34	3	6
5/21	29.9°	124.1°	0000	98	36	22	02	8	1018.3	7	1.7	63.3	57.0	62.8	6	6	3	5	0	0	34	3	6
5/21	29.8°	124.0°	0600	98	36	21	01	1	1019.0	2	1.0	61.0	56.9	62.8	3	3	1	5	0	0	34	3	6
5/21	29.3°	123.7°	1200	98	34	18	03	1	1017.3	7	1.0	60.9	55.3	63.1	7	7	8	5	0	0	34	3	5
5/21	28.9°	123.4°	1800	98	01	14	02	2	1018.6	2	0.8	61.8	54.8	63.9	7	7	5	5	0	0	35	4	6
5/22	28.9°	123.4°	0000	98	33	14	02	2	1016.3	6	1.8	62.4	55.8	64.1	7	7	5	5	0	0	35	4	6
5/22	28.3°	123.0°	0600	98	35	09	02	2	1016.6	2	0.7	61.9	56.2	63.7	7	7	5	5	0	0	34	3	3
5/22	27.8°	122.5°	1200	98	35	06	02	2	1015.2	6	0.5	61.8	56.3	64.7	8	8	5	5	X	X	35	3	2
5/22	27.3°	122.1°	1800	98	28	06	02	2	1015.6	1	0.7	62.8	56.7	64.8	8	8	5	5	X	X	32	3	2
5/23	27.4°	122.1°	0000	98	35	10	02	2	1014.6	7	0.4	63.9	57.2	65.2	8	8	8	5	X	X	34	3	2
5/23	27.1°	122.0°	0600	98	36	09	02	2	1015.6	1	1.3	63.2	57.7	65.1	8	8	8	5	X	X	34	3	2
5/23	27.1°	122.0°	1200	98	32	11	80	2	1015.2	6	0.8	60.2	57.6	65.0	8	8	7	5	X	X	33	2	1

Table 1.--Summary of weather observations (USWB 1210-F), Hugh M. Smith cruise 52 - con.

Date, 1959	Latitude N.	Longitude W.	Time (GCT)	Visibility	Wind		Weather		Pressure			Temperature (° F.)			Clouds						Waves		
					Direction	Speed (kn.)	Present	Past	Bar. cor. (mb.)	Characteristic	Amt. change	Dry bulb	Wet bulb	Sea water	Total amount	Amount low	Type low	Height low	Type middle	Type high	Direction	Period	Height
5/23	26.9°	121.9°	1800	98	36	08	15	8	1017.6	2	1.6	61.8	58.3	65.0	3	3	9	5	4	0	36	2	1
5/24	26.9°	121.2°	0000	98	03	05	15	8	1016.9	7	0.7	62.3	57.7	66.1	3	3	9	5	7	0	01	3	1
5/24	27.0°	120.9°	0600	98	36	03	15	8	1018.3	2	1.1	63.4	56.0	65.7	7	7	9	5	X	X	36	2	1
5/24	27.0°	120.9°	1200	98	33	11	02	2	1017.6	6	0.4	63.3	54.5	65.2	7	7	5	5	0	0	33	3	2
5/24	27.0°	120.6°	1800	98	36	07	02	2	1019.6	2	0.8	64.8	55.2	65.3	7	7	8	5	0	0	35	4	1
5/25	27.0°	119.8°	0000	98	35	07	02	2	1019.0	8	0.9	64.7	55.3	65.9	6	6	8	5	0	0	35	3	1
5/25	27.0°	119.5°	0600	98	35	11	02	2	1019.6	3	1.0	64.3	56.2	65.2	5	5	8	5	0	0	35	3	1
5/25	27.0°	119.5°	1200	98	34	17	02	2	1018.6	8	0.4	63.7	58.6	65.2	6	6	8	5	0	0	35	2	1
5/25	27.0°	119.1°	1800	98	02	13	02	2	1021.0	2	0.4	64.8	57.2	65.2	6	6	8	5	0	0	35	2	1
5/26	27.1°	118.5°	0000	98	02	14	01	1	1018.6	7	1.5	64.4	57.0	65.5	2	2	1	5	0	0	02	2	1
5/26	27.7°	118.4°	0600	98	01	18	02	0	1019.0	1	0.6	62.9	57.3	65.0	3	X	X	X	X	X	36	2	X
5/26	28.6°	118.2°	1200	98	35	15	03	1	1018.3	6	0.7	61.4	56.8	64.1	7	7	8	5	0	0	02	2	0
5/26	29.5°	118.0°	1800	98	34	14	03	2	1018.3	0	0.3	61.2	56.5	64.0	8	8	5	5	X	X	34	2	1
5/27	30.4°	117.9°	0000	98	33	18	02	2	1016.3	7	1.4	61.0	56.5	62.9	8	8	5	5	X	X	34	3	2
5/27	31.2°	117.7°	0600	98	33	17	02	2	1016.3	1	0.5	59.2	54.8	60.7	8	X	X	X	X	X	34	3	4
5/27	32.0°	117.5°	1200	98	33	13	02	2	1015.2	7	0.2	59.9	54.3	62.4	8	8	5	5	X	X	34	2	1
5/31	32.5°	118.2°	0000	98	33	14	02	0	1013.5	7	1.2	60.9	56.8	62.8	1	1	1	5	0	0	31	2	1
5/31	32.5°	118.4°	0600	98	29	12	02	0	1015.2	1	1.0	58.8	55.4	61.8	X	X	X	X	X	X	29	2	1
5/31	32.5°	118.3°	1200	98	29	09	03	1	1015.9	3	0.2	58.4	54.0	61.9	7	7	8	5	0	0	29	2	0
5/31	32.5°	119.1°	1800	98	30	08	02	2	1018.3	1	0.8	57.7	53.8	61.2	8	8	5	5	X	X	29	2	1
6/1	32.3°	119.4°	0000	98	29	13	02	2	1016.9	6	1.0	59.1	54.8	60.0	8	8	5	5	X	X	29	3	1
6/1	32.1°	119.6°	0600	98	31	14	02	2	1017.6	2	1.0	58.6	55.2	60.2	8	8	X	X	X	X	30	2	1
6/1	32.1°	119.6°	1200	98	33	15	02	2	1016.9	4	0.0	57.8	54.8	60.0	8	8	5	5	X	X	32	2	1
6/1	32.1°	119.8°	1800	98	33	13	02	2	1019.0	2	0.6	57.9	54.2	59.6	8	8	5	5	X	X	33	3	2
6/2	32.1°	120.6°	0000	98	33	13	01	2	1018.0	7	1.2	59.3	55.2	59.7	6	6	8	5	0	0	33	3	2
6/2	32.1°	121.5°	0600	98	34	15	03	2	1018.6	1	1.1	58.9	53.9	60.2	8	X	X	X	X	X	34	3	2
6/2	32.1°	122.6°	1200	98	34	16	02	2	1017.6	6	0.7	57.7	52.2	60.0	8	8	5	5	X	X	34	3	2
6/2	32.0°	123.4°	1800	98	35	13	02	2	1020.3	2	0.9	59.2	54.0	60.1	8	8	5	5	X	X	35	2	2
6/2	31.7°	123.6°	2100	98	34	14	02	2	1020.3	8	0.2	60.3	54.0	61.1	8	8	8	5	X	X	34	2	2
6/3	31.5°	123.9°	0000	98	33	14	01	2	1019.6	6	0.4	59.8	54.5	61.2	7	7	8	5	0	0	32	2	2

Table 1.--Summary of weather observations (USWB 1210-F), Hugh M. Smith cruise 52 - con.

Date, 1959	Latitude N.	Longitude W.	Time (GCT)	Visibility	Wind		Weather		Pressure			Temperature (° F.)			Clouds						Waves		
					Direction	Speed (kn.)	Present	Past	Bar. cor. (mb.)	Characteristic	Amt. change	Dry bulb	Wet bulb	Sea water	Total amount	Amount low	Type low	Height low	Type middle	Type high	Direction	Period	Height
6/3	31.3°	124.2°	0300	98	34	15	02	2	1019.6	5	0.0	60.0	54.7	61.0	8	8	5	5	X	X	32	2	2
6/3	31.1°	124.5°	0600	98	34	13	02	2	1021.0	2	1.0	60.0	53.6	61.7	8	X	X	X	X	X	32	2	2
6/3	31.1°	125.0°	1200	98	35	13	02	2	1019.3	7	0.5	59.7	54.7	61.4	8	8	5	5	X	X	33	2	2
6/3	31.0°	125.0°	1800	98	36	12	01	1	1021.3	2	0.7	60.3	55.9	61.9	3	3	2	5	0	0	36	2	2
6/4	31.1°	124.9°	0000	98	36	11	03	1	1020.0	7	1.2	62.3	59.3	62.3	7	7	5	5	0	0	01	2	3
6/4	31.4°	124.9°	0600	98	33	14	02	2	1020.7	3	0.9	61.6	59.2	62.2	7	X	X	X	X	X	33	2	1
6/4	31.0°	125.0°	1200	98	01	13	02	2	1020.3	6	0.6	60.9	58.3	61.4	8	X	X	X	X	X	01	2	1
6/4	30.7°	124.5°	1800	98	36	14	80	8	1021.0	1	0.1	60.9	58.6	61.9	2	2	9	5	0	0	02	2	1
6/5	30.5°	123.9°	0000	98	36	13	80	8	1019.6	7	1.0	61.1	59.3	61.8	7	7	9	5	0	0	02	2	1
6/5	30.5°	123.6°	0600	98	35	15	01	8	1019.6	3	0.4	61.3	58.0	62.2	1	X	X	X	X	X	01	2	1
6/5	30.5°	123.6°	1200	98	01	14	03	1	1018.6	6	0.6	60.0	57.6	62.0	8	X	X	X	X	X	01	2	2
6/5	30.4°	123.3°	1800	98	33	17	15	8	1019.3	1	0.2	61.9	59.7	62.8	8	8	7	5	X	X	35	3	5
6/6	30.3°	122.6°	0000	97	35	17	50	5	1017.3	7	1.4	61.9	59.9	63.0	7	7	7	5	0	0	36	4	6
6/6	30.3°	122.0°	0600	97	36	13	51	5	1016.3	3	0.2	60.8	59.6	62.2	8	X	X	X	X	X	36	4	5
6/6	30.3°	121.4°	1200	98	36	16	28	4	1015.9	4	0.0	60.6	57.7	61.8	6	6	7	3	0	0	33	4	3
6/6	30.0°	120.9°	1800	98	35	15	01	1	1016.6	2	0.7	62.3	59.1	62.1	3	3	1	5	0	0	33	4	3
6/7	30.0°	120.9°	0000	98	32	18	05	0	1015.2	7	1.3	63.2	58.9	62.2	0	0	0	9	0	0	32	4	4
6/7	29.9°	120.3°	0600	98	35	19	00	0	1016.3	2	0.8	61.4	57.4	61.25	0	0	0	9	0	0	34	4	6
6/7	29.8°	119.6°	1200	98	35	18	03	0	1013.9	7	1.0	60.7	57.3	61.0	2	2	1	5	0	0	35	4	5
6/7	29.8°	118.9°	1800	98	34	21	02	0	1014.9	2	0.4	61.4	57.8	61.6	1	1	1	5	0	0	34	4	7
6/8	29.8°	118.1°	0000	98	34	22	02	0	1012.9	7	1.6	63.7	59.3	63.1	1	1	1	5	0	0	34	4	8
6/8	29.4°	117.9°	0600	98	34	19	02	0	1012.9	2	1.7	61.8	58.3	63.8	3	X	X	X	X	X	34	4	6
6/8	29.6°	118.0°	1200	98	35	18	03	1	1012.5	5	0.0	60.7	57.0	63.5	7	7	5	5	0	0	35	4	5
6/8	29.6°	117.9°	1800	98	31	19	02	2	1013.5	2	0.1	62.1	57.9	63.8	7	7	5	5	0	0	31	4	5
6/9	29.7°	117.9°	0000	98	33	17	02	2	1012.5	7	0.9	63.7	57.9	63.9	6	6	5	5	0	0	33	4	6
6/9	29.1°	117.9°	0600	98	33	18	02	2	1013.9	1	0.9	62.5	58.9	64.2	7	X	X	X	X	X	33	4	5
6/9	28.9°	118.1°	1200	98	01	07	01	1	1012.5	7	0.6	62.9	58.9	64.7	3	3	5	5	0	0	34	3	7
6/9	29.1°	118.2°	1800	98	32	17	03	1	1013.9	2	0.4	61.9	58.3	64.7	6	6	5	5	0	0	32	3	4
6/10	28.7°	118.0°	0000	98	27	07	01	1	1011.9	7	1.8	65.5	59.4	64.9	1	1	5	5	0	0	32	3	4
6/10	28.8°	118.0°	0600	98	35	17	03	1	1012.2	3	0.6	62.8	59.7	64.8	7	X	X	X	X	X	34	3	3

Table 1.--Summary of weather observations (USWB 1210-F), Hugh M. Smith cruise 52 - con.

Date, 1959	Latitude N.	Longitude W.	Time (GCT)	Visibility	Wind		Weather		Pressure			Temperature (° F.)			Clouds						Waves		
					Direction	Speed (kn.)	Present	Past	Bar. cor. (mb.)	Characteristic	Amt. change	Dry bulb	Wet bulb	Sea water	Total amount	Amount low	Type low	Height low	Type middle	Type high	Direction	Period	Height
6/10	28.8°	118.0°	1200	98	35	15	02	2	1010.8	6	0.7	61.8	58.7	64.2	8	8	5	5	X	X	34	3	3
6/10	29.0°	117.5°	1800	98	34	09	02	2	1012.9	1	1.0	62.8	58.4	64.0	8	8	5	5	X	X	34	4	4
6/11	29.5°	117.0°	0000	98	32	14	02	2	1011.2	7	1.4	63.0	58.7	63.7	7	7	5	5	0	0	33	4	5
6/11	29.4°	117.0°	0600	98	35	11	02	2	1012.2	1	0.9	61.4	57.8	63.4	7	7	5	5	0	0	34	4	4
6/11	29.1°	116.9°	1200	98	31	08	02	2	1011.2	8	0.7	60.6	57.3	63.1	8	8	5	5	X	X	32	3	2
6/11	29.1°	117.1°	1800	98	32	06	02	2	1013.2	0	0.4	62.1	57.8	63.9	8	8	5	5	X	X	31	5	5
6/12	28.7°	117.6°	0000	98	31	05	02	2	1012.9	7	0.2	65.2	59.6	65.8	7	7	5	5	0	0	31	5	7
6/12	28.6°	118.3°	0600	98	35	07	02	2	1013.9	2	1.2	62.2	57.9	64.6	7	7	5	5	0	0	31	5	5
6/12	28.4°	119.1°	1200	98	29	09	02	2	1013.9	5	0.0	61.6	56.7	64.1	8	8	5	5	X	X	32	4	4
6/12	28.2°	119.5°	1800	98	29	05	02	2	1016.3	1	0.8	63.2	57.2	64.2	8	8	5	5	X	X	32	4	4
6/13	28.2°	119.7°	0000	98	30	08	01	2	1014.6	8	1.2	64.3	57.9	65.1	4	4	5	5	0	0	31	4	5
6/13	28.1°	120.1°	0600	98	33	08	03	2	1015.6	2	1.0	62.8	57.3	65.8	6	6	5	5	0	0	32	3	3
6/13	27.8°	121.1°	1200	98	33	10	02	2	1015.2	5	0.0	62.1	56.7	65.8	7	7	5	5	0	0	32	3	3
6/13	27.6°	121.6°	1800	98	02	09	02	2	1016.9	1	0.5	63.9	58.4	64.7	8	8	5	5	X	X	04	2	2
6/14	27.4°	122.0°	0000	98	01	15	02	2	1015.2	7	1.0	63.9	59.6	65.4	7	7	8	5	0	0	35	3	3
6/14	27.5°	122.3°	0600	98	36	10	02	2	1016.3	1	0.9	62.6	57.3	64.6	8	8	5	5	X	X	36	3	2
6/14	27.6°	122.3°	1200	98	35	14	02	2	1014.9	6	0.8	62.3	58.6	64.8	8	8	5	5	X	X	35	3	3
6/14	27.5°	122.1°	1800	98	01	17	01	2	1015.6	4	0.0	63.6	58.6	64.8	4	4	1	5	0	0	34	3	4
6/15	27.5°	122.2°	0000	98	01	20	01	1	1013.9	7	1.0	63.9	59.3	64.5	2	2	1	5	0	0	01	3	5
6/15	28.1°	121.9°	0600	98	01	18	03	1	1014.6	1	1.0	62.6	59.2	64.4	4	4	1	5	0	0	02	3	6
6/15	28.5°	121.6°	1200	98	01	19	02	2	1013.5	6	0.8	62.2	58.2	65.0	4	4	8	5	0	0	02	3	6
6/15	28.9°	121.3°	1800	98	36	19	02	2	1016.3	1	0.9	62.7	58.0	64.2	5	5	8	5	0	0	36	3	6
6/16	29.4°	121.0°	0000	98	35	19	02	2	1014.6	8	1.0	62.0	57.4	64.5	5	5	8	5	0	0	35	3	6
6/16	29.4°	120.6°	0600	98	35	20	01	1	1014.2	2	0.2	60.2	56.8	62.1	3	3	8	5	0	0	36	3	8
6/16	30.5°	119.7°	1200	98	35	22	03	1	1013.5	5	0.2	59.2	55.8	61.3	5	5	8	5	0	0	35	3	7
6/16	30.7°	119.2°	1800	98	35	23	01	1	1013.9	6	0.5	61.1	57.0	61.8	1	1	1	5	0	0	36	3	7
6/17	30.8°	119.0°	0000	98	36	22	02	0	1011.5	7	1.6	63.0	59.7	62.2	1	1	1	5	0	0	36	3	9
6/17	31.2°	119.3°	0600	98	33	20	02	0	1012.9	1	0.6	61.0	56.7	60.7	0	0	0	9	0	0	34	3	8
6/17	31.1°	119.3°	1200	98	31	20	02	0	1011.5	4	0.0	60.5	57.0	61.0	0	0	0	9	0	0	34	3	5
6/17	30.8°	119.2°	1800	98	32	19	02	0	1012.2	4	0.0	62.6	58.8	62.4	0	0	0	9	0	0	32	3	7

Table 1.--Summary of weather observations (USWB 1210-F), Hugh M. Smith cruise 52 - con.

Date, 1959	Latitude N.	Longitude W.	Time (GCT)	Visibility	Wind		Weather		Pressure			Temperature (° F.)			Clouds						Waves		
					Direction	Speed (kn.)	Present	Past	Bar. cor. (mb.)	Characteristic	Amt. change	Dry bulb	Wet bulb	Sea water	Total amount	Amount low	Type low	Height low	Type middle	Type high	Direction	Period	Height
6/18	31.0°	119.2°	0000	98	33	18	02	0	1009.8	7	0.8	62.9	59.6	62.4	0	0	0	9	0	0	34	3	6
6/18	31.4°	119.3°	0600	98	33	15	02	0	1010.2	2	0.6	60.9	58.9	61.0	0	0	0	9	0	0	34	4	5
6/18	31.2°	119.0°	1200	98	29	15	02	0	1009.5	7	0.7	61.8	59.8	61.5	0	0	0	9	0	0	31	2	3
6/18	31.5°	118.5°	1800	98	31	09	03	1	1011.2	3	1.1	61.2	57.7	62.4	8	8	5	5	X	X	30	2	2
6/19	31.8°	117.9°	0000	98	27	07	02	2	1009.5	6	1.0	62.6	59.6	65.8	7	7	5	5	0	0	28	2	2
6/19	32.0°	117.8°	0600	98	35	05	02	2	1010.8	1	1.2	63.4	61.2	65.2	7	7	5	5	0	0	33	2	0
6/19	32.0°	117.8°	1200	98	32	10	02	2	1010.2	7	0.2	59.3	57.2	64.7	7	7	5	5	0	0	31	2	0
6/19	32.6°	117.8°	1800	97	28	09	02	2	1011.9	1	1.0	63.2	60.7	64.8	8	8	5	5	X	X	29	2	1

Table 2.--Summary of observations at bathythermograph lowerings, Hugh M. Smith cruise 52

Ser. No.	Time, (GCT)	Date, 1959	Latitude N.	Longitude W.	Bkt. temp., (°F.)	Wind		Air temp.		Barometer, (mb.)	Weather	Clouds		Visibility	Sea	Swell		Surf. sal., (‰)	Surf. PO_4-P, µg·at./l.
						Dir., (°T.)	Force, (kn.)	Dry bulb, (°F.)	Wet bulb, (°F.)			Type	Cover			Dir. (°T.)	Amt.		
1	1745	4/29	22°48'	155°58'	72.2	13	19	71.2	68.7	1022	95	8,7	6	7	3	11	1	-	-
2	2300	4/29	23°12'	155°28'	73.0	07	14	75.2	69.8	1021	01	8,6	1	7	2	07	1	35.00	0.34
3	0600	4/30	23°50'	154°41'	73.1	08	15	73.0	68.8	1021	02	9,6	1	7	3	08	2	35.00	0.42
4	1200	4/30	24°23'	153°56'	73.1	11	16	72.2	67.5	1021	02	8	1	7	2	10	1	34.89	0.28
5	1800	4/30	24°58'	153°11'	72.7	10	16	73.7	66.4	1022	25	8,9	2	7	2	10	1	34.87	0.42
6	2200	4/30	25°22'	152°44'	73.2	09	13	73.4	66.4	1022	02	8	1	7	2	10	1	34.75	0.81
7	0600	5/1	26°10'	151°49'	72.2	10	14	72.4	65.2	1022	02	9,8	1	7	2	06	1	34.97	0.44
8	1205	5/1	26°47'	151°02'	71.2	11	09	71.5	67.8	1021	02	8	1	7	2	10	1	35.07	0.15
9	1800	5/1	27°25'	150°16'	68.8	11	17	70.4	65.0	1022	15	8,6	6	7	3	11	2	35.19	0.36
10	2155	5/1	27°48'	149°48'	68.8	10	14	71.0	64.4	1023	02	6	6	7	3	10	2	35.15	0.49
11	0600	5/2	28°40'	148°48'	68.0	09	15	69.0	61.8	1024	02	8	2	7	2	10	2	35.11	0.49
12	1200	5/2	29°17'	148°02'	67.7	11	14	66.9	59.7	1024	00	X	X	7	2	10	2	35.17	0.12
13	1800	5/2	29°55'	147°14'	67.1	12	14	66.7	59.3	1027	03	6	7	7	2	12	1	35.09	0.26
14	2200	5/2	30°20'	146°42'	66.3	10	10	67.8	59.0	1027	01	1,8	2	7	2	10	1	34.97	0.32
15	0600	5/3	31°08'	145°40'	64.9	10	13	64.7	57.8	1028	02	8,1,2	4	7	1	02	1	34.61	0.58
16	1203	5/3	31°46'	144°50'	65.2	11	12	63.8	57.4	1027	03	8,1,2	5	7	1	06	1	34.86	0.20
17	1800	5/3	32°22'	144°02'	63.4	14	10	63.4	55.6	1029	03	8,1,2	6	7	1	10	1	34.29	0.22
18	2055	5/3	32°36'	143°45'	64.1	15	08	65.6	56.0	1030	02	8,1,2	7	7	1	02	2	34.43	0.20
19	0000	5/4	32°51'	143°24'	63.8	15	11	64.8	57.5	1029	01	8,1,2	4	7	1	05	2	34.30	0.22
20	0600	5/4	33°18'	142°47'	62.7	16	10	63.0	57.2	1030	02	8,1,2	4	7	1	05	2	34.12	0.15
21	1200	5/4	33°41'	142°11'	61.7	16	12	61.8	56.3	1028	01	1,6	1	7	1	15	1	34.15	0.22
22	1800	5/4	34°08'	141°34'	61.4	18	11	62.6	56.8	1029	03	1,8,6	3	7	1	02	2	34.01	0.17
23	2055	5/4	34°22'	141°14'	62.1	20	11	63.8	57.3	1029	03	1,2,8	7	7	1	02	1	34.06	1.65
24	0000	5/5	34°36'	140°58'	62.3	23	10	64.2	58.0	1029	02	2,6	7	7	1	22	1	34.04	-
25	0340	5/5	34°48'	140°42'	62.1	22	08	63.4	57.4	1029	03	6,2	8	7	1	21	1	34.04	0.20
26	0350	5/5	34°48'	140°42'	62.1	22	08	63.4	57.4	1029	03	6,2	8	7	1	21	1	34.04	0.20
27	1540	5/5	34°50'	140°42'	61.9	23	10	63.2	59.8	1030	01	None	0	7	1	23	1	-	-
28	1800	5/5	35°02'	140°30'	61.0	25	07	62.7	59.5	1031	03	2,6,8	1	7	1	29	1	33.89	0.31
29	2055	5/5	35°16'	140°14'	62.0	22	06	65.6	60.7	1032	03	1,2,8,6	3	7	1	29	2	33.90	0.33
30	0000	5/6	35°28'	139°54'	62.9	24	06	65.4	60.4	1031	03	1,2,8,5	2	7	1	29	2	33.93	0.59

Table 2.--Summary of observations at bathythermograph lowerings, Hugh M. Smith cruise 52 - con.

Ser. No.	Time, (GCT)	Date, 1959	Latitude N.	Longitude W.	Bkt. temp., (°F.)	Wind		Air temp.		Baro meter, (mb.)	Wea-ther	Clouds		Visibility	Sea	Swell		Surf. sal., (‰)	Surf. PO_4-P, µg.at./l.
						Dir., (°T.)	Force, (kn.)	Dry bulb, (°F.)	Wet bulb, (°F.)			Type	Cover			Dir. (°T.)	Amt.		
31	0555	5/6	35°54'	139°15'	60.8	24	06	61.3	59.8	1032	03	1,2,8	3	7	1	29	2	33.75	0.36
32	1200	5/6	36°24'	138°37'	60.6	23	03	60.4	59.6	1031	01	X	1	7	X	X	X	33.71	0.34
33	1745	5/6	36°48'	138°00'	61.3	26	03	62.7	59.4	1032	03	5,1,2,8	2	7	0	30	2	33.73	0.42
34	1800	5/6	36°48'	138°02'	61.3	26	03	62.7	59.4	1032	03	5,1,2,8	2	7	0	30	2	34.73	0.42
35	0032	5/7	36°49'	138°04'	62.0	25	07	65.3	59.3	1030	02	1,2,3,8	3	7	0	28	2	-	-
36	0600	5/7	37°14'	137°30'	61.0	23	06	61.9	58.8	1030	02	1,2,4,8	3	7	0	29	2	33.57	0.31
37	1200	5/7	37°45'	136°49'	58.8	23	09	62.6	58.9	1027	02	X	3	7	0	XX	X	33.46	0.34
38	1800	5/7	38°15'	136°10'	58.1	20	07	62.4	59.8	1027	03	5,2,6,9	7	7	1	28	2	33.41	0.36
39	2052	5/7	38°28'	135°52'	58.4	23	06	62.9	59.6	1027	02	5,2,6,9	7	7	1	28	2	33.17	0.44
40	0000	5/8	38°41'	135°32'	58.6	23	06	64.7	60.2	1026	01	8,4,5,1, 2	6	7	1	28	2	33.13	0.52
41	0345	5/8	38°55'	135°12'	57.5	22	05	63.7	59.9	1027	01	1,2,4,8	3	7	1	28	5	33.21	0.55
42	0350	5/8	38°55'	135°12'	57.5	22	05	63.7	59.9	1027	01	1,2,4,8	3	7	1	28	5	33.21	0.55
43	1559	5/8	38°48'	135°06'	56.9	35	15	56.9	54.2	1031	20	7,8	8	7	2	35	2	-	-
44	2055	5/8	38°29'	134°40'	57.5	35	13	57.7	54.1	1033	02	7,8	7	7	2	35	1	33.12	0.36
45	0000	5/9	38°15'	134°22'	58.0	35	14	57.6	52.7	1032	02	6	7	7	2	35	1	33.27	0.30
46	0555	5/9	37°46'	133°45'	58.25	01	15	56.6	51.2	1033	01	1,2,6	6	7	3	33	5	33.16	0.64
47	1200	5/9	37°18'	133°10'	59.4	01	08	55.8	50.6	1031	01	1,2,6	3	7	2	XX	X	33.28	0.58
48	1800	5/9	36°51'	132°34'	60.6	36	14	59.0	53.8	1032	03	6	7	7	3	35	2	33.47	0.30
49	2052	5/9	36°41'	132°21'	61.3	35	11	59.8	54.1	1031	03	6	8	7	4	35	4	33.62	0.51
50	2358	5/9	36°32'	132°10'	61.0	36	12	59.8	54.3	1029	02	6	8	7	4	32	4	33.58	0.97
51	0440	5/10	36°42'	132°24'	61.2	35	14	59.5	57.0	1028	50	7,6	8	5	4	32	4	33.65	0.34
52	0448	5/10	36°42'	132°24'	61.2	35	14	59.5	57.0	1028	50	7,6	8	5	4	32	4	33.65	0.34
53	1600	5/10	36°39'	132°24'	61.0	36	13	56.9	55.3	1024	80	7,6	7	7	2	36	1	-	-
54	2102	5/10	36°18'	131°49'	60.6	04	12	59.5	56.5	1023	01	6	6	7	2	02	1	33.58	0.55
55	0000	5/11	36°03'	131°32'	60.25	05	12	59.4	54.2	1020	02	7	7	7	2	04	1	33.57	1.26
56	0600	5/11	35°35'	130°59'	59.8	07	12	57.3	54.5	1018	01	X	3	7	2	05	1	33.22	0.51
57	1205	5/11	35°09'	130°22'	60.0	04	12	57.8	55.0	1016	01	1,2	2	7	2	05	1	33.36	0.74
58	1807	5/11	34°41'	129°44'	59.1	04	14	60.8	55.8	1015	01	8,1,2	2	7	3	35	4	33.16	0.38
59	2019	5/11	34°32'	129°32'	59.7	03	12	60.3	55.7	1014	02	8	1	7	3	36	4	33.20	0.51
60	0004	5/12	34°14'	129°09'	60.9	04	14	59.6	56.6	1012	02	8	2	7	3	35	4	33.30	0.35

Table 2.--Summary of observations at bathythermograph lowerings, Hugh M. Smith cruise 52 - con.

Ser. No.	Time, (GCT)	Date, 1959	Latitude N.	Longitude W.	Bkt. temp., (°F.)	Wind		Air temp.		Barometer, (mb.)	Weather	Clouds		Visibility	Sea	Swell		Surf. sal., (‰)	Surf. PO_4-P, µg.at./l.
						Dir., (°T.)	Force, (kn.)	Dry bulb, (°F.)	Wet bulb, (°F.)			Type	Cover			Dir. (°T.)	Amt.		
61	0603	5/12	33°48'	128°36'	60.2	07	08	58.6	55.7	1012	03	X	3	7	3	35	4	33.20	0.38
62	1807	5/15	37°24'	123°02'	51.8	32	28	55.6	51.2	1021	02	X	0	7	5	30	3	-	-
63	1803	5/16	35°58'	125°46'	57.1	32	13	57.8	54.1	1022	03	1,2,8	6	7	3	32	1	-	-
64	0000	5/17	35°12'	126°26'	59.6	31	15	61.6	56.2	1022	02	1,2,8	6	7	2	32	1	-	-
65	0602	5/17	34°24'	127°04'	59.2	31	14	61.3	56.9	1022	03	2	7	7	2	31	1	-	-
66	1200	5/17	33°42'	127°53'	61.0	31	16	61.3	57.8	1021	01	X	0	7	2	31	1	33.28	-
67	1639	5/17	33°18'	127°58'	60.9	35	17	63.6	59.3	1023	03	9,8,4	6	7	2	30	1	-	0.45
68	1647	5/17	33°18'	127°58'	60.9	35	17	63.6	59.3	1023	03	9,8,4	6	7	2	30	1	33.28	0.45
69	2307	5/17	33°23'	128°00'	61.8	36	09	65.8	55.7	1024	02	1,2,4,8	5	7	1	36	1	-	-
70	0603	5/18	32°46'	127°13'	61.5	36	07	61.6	56.8	1024	01	8	1	7	1	36	1	33.40	0.32
71	1205	5/18	32°06'	126°21'	60.9	36	10	59.9	55.1	1022	03	X	7	7	1	36	1	33.59	0.33
72	1803	5/18	31°36'	125°43'	61.25	01	16	62.0	56.0	1024	01	8	2	7	2	34	1	33.52	0.33
73	1954	5/18	31°28'	125°33'	61.9	01	17	61.3	55.0	1024	01	8,4	1	7	2	36	4	33.69	0.22
74	0003	5/19	31°10'	125°13'	62.0	36	21	61.3	56.2	1022	02	4,8,9	6	7	3	35	4	33.66	0.27
75	0600	5/19	30°44'	124°48'	61.8	01	21	60.6	53.7	1023	02	8,6	6	7	3	02	4	33.59	0.33
76	1203	5/19	30°10'	124°21'	62.0	01	23	60.2	54.9	1020	02	8,6	5	7	3	02	4	33.60	0.17
77	1805	5/19	29°37'	124°07'	62.9	36	26	63.8	58.0	1022	01	8,9	4	7	3	02	6	33.72	0.31
78	2357	5/19	29°04'	123°43'	63.5	02	24	63.6	58.7	1019	01	8	3	7	3	36	4	33.88	0.35
79	2000	5/20	29°39'	123°56'	63.0	36	23	62.6	58.6	1020	80	8,9	6	7	3	36	4	-	-
80	1635	5/21	28°53'	123°25'	63.8	36	14	61.8	55.6	1018	03	6	8	7	3	34	4	34.10	0.32
81	1642	5/21	28°55'	123°26'	63.8	36	14	61.8	55.6	1018	03	6	8	7	3	34	4	34.10	0.32
82	2305	5/21	28°55'	123°28'	64.0	34	15	62.8	56.7	1017	02	6	7	7	3	34	4	-	-
83	0603	5/22	28°20'	122°58'	63.7	35	09	61.9	56.2	1017	02	6	7	7	2	34	1	33.96	0.29
84	1157	5/22	27°46'	122°29'	64.7	35	06	61.8	56.3	1015	02	6	8	7	1	35	1	34.28	0.25
85	1643	5/22	27°21'	122°08'	64.7	32	07	63.6	56.7	1016	02	6	8	7	1	32	1	34.28	0.26
86	1651	5/22	27°22'	122°08'	64.7	32	07	63.6	56.7	1016	02	6	8	7	1	32	1	34.28	0.26
87	2303	5/22	27°24'	122°09'	65.1	34	11	64.0	57.6	1015	02	6	8	7	1	34	1	-	-
88	2310	5/22	27°24'	122°09'	65.1	34	11	64.0	57.6	1015	02	6	8	7	1	34	1	-	-
89	0307	5/23	27°07'	122°03'	65.0	33	10	63.7	55.3	1015	02	6,8	8	7	1	33	1	34.16	0.28
90	0312	5/23	27°07'	122°03'	65.0	33	10	63.7	55.3	1015	02	6,8	8	7	1	33	1	34.16	0.28

Table 2.--Summary of observations at bathythermograph lowerings, Hugh M. Smith cruise 52 - con.

Ser. No.	Time, (GCT)	Date, 1959	Latitude N.	Longitude W.	Bkt. temp., (°F.)	Wind		Air temp.		Barometer, (mb.)	Weather	Clouds		Visibility	Sea	Swell		Surf. sal., (‰)	Surf. PO_4-P, µg at./l.
						Dir., (°T.)	Force, (kn.)	Dry bulb, (°F.)	Wet bulb, (°F.)			Type	Cover			Dir. (°T.)	Amt.		
91	1455	5/23	26°59'	121°59'	64.9	01	10	59.7	57.3	1016	16	6,8,9	4	7	1	33	1	-	-
92	1803	5/23	26°53'	121°50'	65.0	36	08	61.8	58.3	1018	15	6,8,4,9	3	7	1	36	1	34.12	0.26
93	2020	5/23	26°52'	121°34'	66.0	03	03	63.0	58.0	1018	15	6,5,8,9	2	7	1	36	3	34.06	0.26
94	0003	5/24	26°56'	121°10'	66.1	03	05	62.3	57.7	1017	15	6,5,8,9	3	7	1	01	1	34.03	0.29
95	0230	5/24	27°00'	120°56'	65.8	01	07	62.9	57.6	1017	15	2,6,4,8,9	3	7	1	35	1	34.00	0.27
96	0236	5/24	27°00'	120°56'	65.8	01	07	62.9	57.6	1017	15	2,6,4,8,9	3	7	1	35	1	34.00	0.27
97	1448	5/24	26°58'	120°56'	65.1	35	07	63.6	55.3	1019	02	6	7	7	1	36	1	-	-
98	1802	5/24	26°59'	120°34'	65.3	36	07	64.8	55.2	1020	02	6,8	7	7	1	35	1	34.02	0.26
99	2020	5/24	27°00'	120°18'	65.9	36	10	64.8	56.4	1020	02	6,8	7	7	1	36	1	34.06	0.26
100	0002	5/25	27°00'	119°48'	65.9	35	07	64.7	55.3	1019	02	6,8	6	7	1	35	1	33.98	0.31
101	0239	5/25	27°00'	119°31'	65.5	35	11	64.2	55.3	1018	01	6,8	2	7	1	35	1	33.97	0.29
102	0246	5/25	27°00'	119°31'	65.5	35	11	64.2	55.3	1018	01	6,8	2	7	1	35	1	33.97	0.29
103	1407	5/25	26°58'	119°32'	65.0	36	17	64.0	58.0	1020	02	6,8	3	7	2	35	1	-	-
104	1805	5/25	27°02'	119°07'	65.2	02	13	64.8	57.2	1021	02	6,8	6	7	2	35	1	34.03	0.28
105	1953	5/25	27°04'	118°54'	65.7	02	13	64.8	58.0	1021	01	8,5	3	7	2	36	1	34.05	0.27
106	2335	5/25	27°04'	118°27'	65.5	02	14	64.4	57.0	1019	01	8	2	7	2	02	1	34.03	0.30
107	0601	5/26	27°44'	118°22'	64.0	01	18	62.9	57.3	1019	02	X	3	7	2	36	X	33.81	0.30
108	1205	5/26	28°39'	118°14'	64.1	35	15	61.4	56.8	1018	03	8,6	7	7	2	35	1	33.88	0.30
109	1744	5/26	29°32'	118°03'	64.0	34	14	61.2	56.5	1018	03	6	8	7	2	35	1	33.73	0.32
110	1955	5/26	29°51'	117°59'	62.2	34	15	61.0	56.5	1018	02	6	8	7	2	34	1	33.61	0.32
111	0003	5/27	30°23'	117°53'	62.9	33	18	61.0	56.5	1016	02	6	8	7	3	34	1	33.64	0.30
112	0602	5/27	31°10'	117°44'	61.0	33	17	59.2	54.8	1016	02	X	8	7	3	34	3	33.60	0.32
113	1200	5/27	32°91'	117°30'	62.4	33	13	59.9	54.3	1015	02	6	8	7	2	34	1	33.69	0.31
114	1857	5/30	32°30'	117°36'	65.2	29	07	60.3	55.2	1016	02	X	8	7	1	28	1	-	-
115	1952	5/30	32°30'	117°44'	64.1	30	12	59.8	55.0	1016	02	X	0	7	1	28	1	33.70	0.32
116	0000	5/31	32°30'	118°10'	62.8	31	14	60.9	56.8	1014	02	8	1	7	1	31	1	33.67	0.37
117	0245	5/31	32°30'	118°20'	62.1	29	12	59.6	55.5	1014	02	8,1,2	1	7	1	28	1	33.67	0.34
118	0250	5/31	32°30'	118°20'	62.1	29	12	59.6	55.5	1014	02	8,1,2	1	7	1	28	1	33.67	0.34
119	1500	5/31	32°33'	118°26'	62.0	28	08	58.1	54.2	1018	02	6	8	7	1	29	1	33.69	0.37
120	1507	5/31	32°33'	118°26'	62.0	28	08	58.1	54.2	1018	02	6	8	7	1	29	1	33.69	0.37

Table 2.--Summary of observations at bathythermograph lowerings, Hugh M. Smith cruise 52 - con.

Ser. No.	Time, (GCT)	Date, 1959	Latitude N.	Longitude W.	Bkt. temp., (°F.)	Wind		Air temp.		Barometer, (mb.)	Weather	Clouds		Visibility	Sea	Swell		Surf. sal., (‰)	Surf. PO_4-P, µg.at./l.
						Dir., (°T.)	Force, (kn.)	Dry bulb, (°F.)	Wet bulb, (°F.)			Type	Cover			Dir. (°T.)	Amt.		
121	1800	5/31	32°33'	118°48'	61.2	30	08	57.7	53.8	1018	02	6	8	7	1	29	1	33.65	0.39
122	1951	5/31	32°33'	119°06'	58.8	30	07	58.8	54.3	1018	02	6	8	7	0	29	1	33.58	0.48
123	0000	6/1	32°18'	119°26'	60.0	29	13	59.1	54.8	1017	02	6	8	7	0	29	1	33.59	0.37
124	0240	6/1	32°08'	119°36'	60.0	30	17	58.0	54.7	1016	02	6	8	7	1	29	1	33.48	0.86
125	0245	6/1	32°08'	119°36'	60.0	30	17	58.0	54.7	1016	02	6	8	7	1	29	1	33.48	0.86
126	1458	6/1	32°05'	119°28'	60.0	31	13	57.4	53.7	1019	02	6	8	7	1	31	1	-	-
127	1755	6/1	32°05'	119°50'	59.6	33	13	57.9	54.2	1019	02	6	8	7	2	33	1	33.53	0.37
128	1956	6/1	32°04'	120°04'	59.8	34	10	58.3	54.2	1019	02	6	8	7	2	33	1	33.46	0.41
129	0002	6/2	32°06'	120°36'	59.7	33	13	59.3	55.2	1018	01	6,8	6	7	2	33	1	33.51	0.43
130	0600	6/2	32°07'	121°32'	60.2	34	15	58.9	53.9	1019	03	X	8	7	2	34	1	33.40	0.37
131	1200	6/2	32°08'	122°36'	60.0	34	16	57.7	52.2	1017	02	6	8	7	2	34	1	33.34	0.89
132	1802	6/2	31°58'	123°23'	60.1	35	13	59.2	54.0	1020	02	6	8	7	1	35	1	33.32	0.36
133	1951	6/2	31°50'	123°33'	61.0	36	11	59.9	54.2	1021	02	6,8	8	7	1	35	1	33.54	0.37
134	0001	6/3	31°30'	123°56'	61.2	33	14	59.8	54.5	1020	01	6,8	7	7	1	32	1	33.57	0.34
135	0602	6/3	31°09'	124°32'	61.7	34	13	60.0	53.6	1021	02	X	8	7	1	32	1	33.60	0.50
136	1652	6/3	31°04'	124°54'	61.7	01	16	60.3	55.4	1021	01	8	5	7	1	01	1	33.59	0.38
137	1657	6/3	31°05'	124°55'	61.7	01	16	60.3	55.4	1021	01	8	5	7	1	01	1	33.59	0.38
138	2316	6/3	31°07'	124°56'	62.25	36	11	62.3	59.3	1020	02	6	7	7	1	01	1	-	-
139	1204	6/4	30°51'	125°04'	61.4	01	13	60.9	58.3	1020	02	X	8	7	1	01	1	-	-
140	1758	6/4	30°42'	124°32'	61.9	36	14	60.9	58.6	1021	80	9,8	2	7	1	02	1	33.53	-
141	1952	6/4	30°39'	124°20'	61.5	35	11	61.3	58.7	1021	15	9,8	3	7	1	36	1	33.48	0.46
142	0003	6/5	30°32'	123°51'	61.8	36	13	61.1	59.3	1020	80	8,9	7	7	1	02	1	33.48	0.41
143	0242	6/5	30°29'	123°38'	62.2	36	13	60.4	58.2	1019	16	7,8,9	7	7	1	02	1	33.54	0.37
144	0248	6/5	30°29'	123°38'	62.2	36	13	60.4	58.2	1019	16	7,8,9	7	7	1	02	1	33.54	0.37
145	1456	6/5	30°24'	123°35'	62.8	34	13	60.4	58.6	1019	80	7	8	7	2	35	3	-	-
146	1814	6/5	30°22'	123°20'	62.8	33	17	61.9	59.7	1019	15	8	8	7	2	35	3	33.68	-
147	1958	6/5	30°20'	123°06'	62.8	36	15	62.2	59.8	1019	16	8	7	7	2	36	3	33.69	0.35
148	0004	6/6	30°16'	122°39'	63.0	35	17	61.9	59.9	1017	50	8	7	6	2	36	3	33.72	0.54
149	0546	6/6	30°16'	122°02'	62.2	36	13	60.8	59.6	1016	51	8	8	6	2	36	3	33.56	0.37
150	1204	6/6	30°19'	121°21'	61.8	36	16	60.6	57.7	1016	28	8	6	7	2	33	1	33.55	0.40

Table 2.--Summary of observations at bathythermograph lowerings, Hugh M. Smith cruise 52 - con.

Ser. No.	Time, (GCT)	Date, 1959	Latitude N.	Longitude W.	Bkt. temp., (°F.)	Wind		Air temp.		Barometer, (mb.)	Weather	Clouds		Visibility	Sea	Swell		Surf. sal., (‰)	Surf. PO_4-P, μg.at./l.
						Dir., (°T.)	Force, (kn.)	Dry bulb, (°F.)	Wet bulb, (°F.)			Type	Cover			Dir. (°T.)	Amt.		
151	1641	6/6	30°01'	120°55'	61.9	34	14	62.1	58.9	1016	01	8	2	7	2	33	3	33.55	0.39
152	1649	6/6	30°01'	120°55'	61.9	34	14	62.1	58.9	1016	01	8	2	7	2	33	3	33.55	0.39
153	2310	6/6	30°00'	120°56'	62.2	33	17	63.1	58.9	1016	02	X	0	7	2	33	4	-	-
154	0542	6/7	29°52'	120°21'	61.25	35	19	61.4	57.4	1016	00	X	0	7	2	34	4	33.47	0.36
155	1200	6/7	29°50'	119°37'	61.0	35	18	60.7	57.3	1014	03	8	2	7	2	35	4	33.56	0.38
156	1810	6/7	29°48'	118°51'	61.6	34	21	61.4	57.8	1015	02	8	1	7	3	34	4	33.50	0.38
157	1958	6/7	29°48'	118°38'	62.0	34	21	62.0	58.4	1014	02	8	1	7	3	34	7	33.49	0.36
158	0006	6/8	29°49'	118°05'	63.1	34	22	63.7	59.3	1013	02	8	1	7	3	34	7	33.65	0.31
159	1644	6/8	29°36'	117°52'	63.6	31	17	62.1	57.4	1014	03	6	6	7	2	31	4	33.81	0.31
160	1656	6/8	29°37'	117°53'	63.6	31	17	62.1	57.4	1014	03	6	6	7	2	31	4	33.81	0.31
161	2333	6/8	29°40'	117°53'	63.9	33	17	63.7	57.9	1012	02	6	6	7	3	32	4	-	-
162	0550	6/9	29°04'	117°56'	64.2	33	18	62.5	58.9	1014	02	X	7	7	3	33	4	33.85	0.32
163	1205	6/9	28°53'	118°06'	64.7	01	07	62.4	58.9	1012	01	6	3	7	2	34	1	33.82	0.30
164	1757	6/9	29°09'	118°11'	64.7	32	17	61.9	58.3	1014	03	6	6	7	2	32	4	33.79	0.32
165	1957	6/9	28°58'	118°02'	64.5	36	16	62.9	58.7	1014	01	6,8	3	7	2	33	4	33.84	0.35
166	2247	6/9	28°43'	117°50'	64.6	27	07	65.5	57.8	1013	03	6	7	7	1	33	2	33.75	0.31
167	0307	6/10	28°51'	117°58'	64.5	35	16	62.8	59.8	1012	02	6	5	7	1	35	2	33.80	0.33
168	0312	6/10	28°51'	117°58'	64.5	35	16	62.8	59.8	1012	02	6	5	7	1	35	2	33.80	0.33
169	1413	6/10	28°48'	117°52'	64.2	35	16	61.9	57.8	1012	02	6	7	7	1	35	2	-	-
170	1755	6/10	29°02'	117°31'	64.0	34	09	62.8	58.4	1013	02	6	8	7	1	34	4	33.88	0.35
171	1952	6/10	29°10'	117°19'	64.1	35	11	63.0	58.6	1012	02	6	8	7	1	34	4	33.83	0.94
172	0003	6/11	29°29'	117°00'	63.7	32	14	63.0	58.7	1011	02	6	8	7	1	33	4	33.70	0.34
173	0240	6/11	29°23'	117°00'	63.5	32	12	61.7	57.4	1012	02	6	7	7	1	32	4	33.69	0.42
174	0246	6/11	29°23'	117°00'	63.5	32	12	61.7	57.4	1012	02	6	7	7	1	32	4	33.69	0.42
175	1446	6/11	29°18'	116°53'	63.3	29	06	60.9	57.3	1013	02	6	8	7	1	32	4	-	-
176	1802	6/11	29°07'	117°04'	63.9	32	06	62.1	57.8	1013	02	6	8	7	1	31	4	33.82	0.35
177	1951	6/11	28°58'	117°14'	64.0	32	08	63.3	59.0	1013	01	6	7	7	1	32	7	33.73	0.49
178	0002	6/12	28°44'	117°38'	65.8	31	05	65.2	59.6	1013	02	6	7	7	1	31	7	33.84	0.34
179	0548	6/12	28°34'	118°18'	64.6	35	07	62.2	57.9	1014	02	6	7	7	1	31	7	33.87	0.39
180	1202	6/12	28°23'	119°04'	64.1	29	09	61.6	56.7	1014	02	6	8	7	1	31	4	33.83	0.37

Table 2.--Summary of observations at bathythermograph lowerings, Hugh M. Smith cruise 52 - con.

Ser. No.	Time, (GCT)	Date, 1959	Latitude N.	Longitude W.	Bkt. temp., (°F.)	Wind		Air temp.		Barometer, (mb.)	Weather	Clouds		Visibility	Sea	Swell		Surf. sal., (‰)	Surf. PO_4-P, μg.at./l.
						Dir., (°T.)	Force, (kn.)	Dry bulb, (°F.)	Wet bulb, (°F.)			Type	Cover			Dir. (°T.)	Amt.		
181	1642	6/12	28°14'	119°30'	64.1	30	05	63.3	57.2	1016	02	6	7	7	1	31	4	33.89	-
182	1650	6/12	28°14'	119°31'	64.1	30	05	63.3	57.2	1016	02	6	7	7	1	31	4	33.89	-
183	2300	6/12	28°14'	119°34'	65.0	30	07	64.4	58.3	1015	02	6	7	7	1	31	4	-	-
184	0601	6/13	28°04'	120°24'	65.8	33	08	62.8	57.3	1016	03	6	6	7	1	32	1	34.10	0.45
185	1203	6/13	27°51'	121°08'	65.8	33	10	62.1	56.7	1015	02	6	7	7	1	32	1	34.02	0.42
186	1908	6/13	27°38'	121°43'	64.4	00	10	63.8	58.7	1017	02	6	8	7	1	01	1	34.08	0.31
187	0320	6/14	27°33'	122°15'	64.8	36	17	63.3	57.6	1016	02	6,8	7	7	2	34	4	34.12	0.39
188	0326	6/14	27°33'	122°15'	64.8	36	17	63.3	57.6	1016	02	6,8	7	7	2	34	4	34.12	0.39
189	1500	6/14	27°20'	122°16'	65.0	36	16	63.1	58.1	1016	03	6	7	7	2	35	4	-	-
190	1803	6/14	27°30'	122°09'	64.8	01	17	63.6	58.6	1016	01	8	4	7	2	34	3	34.04	0.25
191	1957	6/14	27°42'	122°02'	64.4	35	16	63.4	58.8	1016	02	8	5	7	2	35	3	33.95	0.31
192	0005	6/15	28°03'	121°50'	64.5	01	20	63.9	59.3	1014	01	8	2	7	2	01	3	33.97	0.35
193	0558	6/15	28°30'	121°35'	64.4	01	18	62.6	59.3	1015	03	8	4	7	2	03	3	34.09	0.31
194	1205	6/15	28°53'	121°16'	65.0	01	19	62.2	58.2	1014	02	6,8	4	7	2	02	3	34.03	0.28
195	1802	6/15	29°22'	121°02'	64.2	36	19	62.7	58.0	1016	02	6,8	5	7	2	36	3	33.89	0.29
196	2005	6/15	29°24'	120°54'	64.7	35	20	62.0	57.8	1016	01	6,8	3	7	2	34	3	33.94	0.20
197	0200	6/16	29°42'	120°33'	63.4	35	20	60.8	57.2	1015	02	6,8	4	7	2	36	6	33.57	0.33
198	0603	6/16	30°02'	120°14'	62.1	35	23	60.2	56.8	1014	01	6,8	3	7	3	36	6	33.55	0.43
199	1203	6/16	30°29'	119°40'	61.3	35	22	59.2	55.8	1014	03	6,8	5	7	3	35	6	33.54	0.38
200	1926	6/16	30°48'	119°16'	61.6	34	19	61.0	57.2	1015	01	8	1	7	3	35	6	33.78	0.21
201	2138	6/17	30°46'	119°11'	62.5	34	18	63.0	59.8	1011	02	0	0	7	3	34	7	33.80	0.24
202	2145	6/17	30°46'	119°11'	62.5	34	18	63.0	59.8	1011	02	0	0	7	3	34	7	33.80	0.24
203	1257	6/18	31°11'	119°02'	61.4	32	15	61.7	59.2	1010	02	8	1	7	2	30	1	33.82	0.33
204	1802	6/18	31°30'	118°28'	62.4	31	09	61.2	57.7	1011	03	6	8	7	1	30	1	33.73	2.40
205	2020	6/18	31°38'	118°15'	64.4	27	09	62.7	59.2	1011	02	6	8	7	1	29	1	33.95	0.28
206	0000	6/19	31°50'	117°54'	65.8	27	07	62.6	59.6	1010	02	6	7	7	1	28	1	33.86	0.32
207	0235	6/19	31°59'	117°46'	65.4	33	09	63.2	61.2	1010	01	8,2	4	7	1	28	1	33.72	0.44
208	0240	6/19	31°59'	117°46'	65.4	33	09	63.2	61.2	1010	01	8,2	4	7	1	28	1	33.72	0.44
209	1443	6/19	32°06'	117°38'	64.7	01	06	61.4	58.2	1012	02	6	8	7	1	31	1	-	-
210	1448	6/19	32°06'	117°38'	64.7	01	06	61.4	58.2	1012	02	6	8	7	1	31	1	-	-
211	1800	6/19	32°24'	117°27'	64.8	28	09	63.2	60.7	1012	02	6	8	6	1	29	1	33.78	0.44
212	1858	6/19	32°34'	117°24'	70.9	26	09	65.7	62.4	1012	02	6	8	6	1	29	1	33.86	0.22

Table 3.--Summary of observations at bathythermograph lowerings, N. B. Scofield cruise 5984

Ser. No.	Time, (GCT)	Date, 1959	Latitude N.	Longitude W.	Bkt. temp., (°F.)	Wind		Air temp.		Barometer, (mb.)	Weather	Clouds		Visibility	Sea	Swell		Surf. sal., (°/oo)	Surf. PO_4-P, µg.at./l.
						Dir., (°T.)	Force, (kn.)	Dry bulb, (°F.)	Wet bulb, (°F.)			Type	Cover			Dir. (°T.)	Amt.		
1	1835	6/3	34°21'	120°44'	56.2	NW	4	-	-	30.01	-	-	8	7	4	-	-	33.61	0.80
2	1250	6/4	34°33'	121°44'	58.8	NW	6-7	68	-	30.11	-	-	0	8	5	-	-	33.22	0.44
3	1355	6/4	34°35'	121°48'	58.3	NW	6-7	68	-	30.11	-	-	0	8	5	-	-	33.29	1.23
4	1940	6/4	34°47.5'	122°19'	59.0	NW	7-8	65	-	30.03	-	-	1	6	5	-	-	33.06	0.55
5	1235	6/5	34°51'	122°38'	58.8	NW	7	62	-	30.03	-	-	8	6	5	-	-	33.16	0.48
6	2000	6/5	35°12'	123°21'	58.9	NW	6	56	-	30.05	-	-	1	7	4	-	-	-	-
7	1223	6/6	35°23'	124°14'	57.3	NW	6	59	-	30.14	-	-	0	8	5	-	-	32.86	0.96
8	1928	6/6	35°45'	124°52'	59.2	NW	6	56	-	30.10	-	-	1	8	4	-	-	32.44	0.50
9	0602	6/7	36°26'	125°55'	58.0	NW	5-6	57	-	30.14	-	-	3	8	4	-	-	32.81	0.44
10	1114	6/7	35°46'	125°51'	60.2	NW	6	58	-	30.16	-	-	2	8	4	-	-	32.99	0.35
11	1942	6/7	34°50'	126°06'	60.9	NW	4	58	-	30.16	-	-	1	8	4	-	-	32.82	0.51
12	1137	6/8	34°08'	126°26'	60.8	NW	3-4	70.5	-	30.16	-	-	9	4	3	-	-	33.16	0.42
13	1945	6/8	33°10'	126°49'	62.6	NW	4	59	-	30.16	-	-	3	8	4	-	-	33.54	0.31
14	0700	6/9	31°46'	127°18.5'	63.3	NW	4	61	-	30.16	-	-	8	8	4	-	-	33.63	0.32
15	1137	6/9	32°12'	127°43'	63.9	NE	4-5	69	-	30.19	-	-	8	8	4	-	-	33.60	0.28
16	1950	6/9	32°24'	128°04'	63.7	NW	6	59	-	30.19	-	-	7	8	5	-	-	33.25	0.35
17	1131	6/10	33°28'	128°14'	63.7	NW	6	65	-	30.14	-	-	4	8	5	-	-	33.13	0.35
18	1949	6/10	34°19'	128°18'	62.3	NW	5	59	-	30.09	-	-	1	8	5	-	-	33.03	0.38
19	1124	6/11	35°00'	128°52'	61.8	NW	1	64	-	30.08	-	-	2	8	3	-	-	36.52	0.24
20	1904	6/11	35°35'	128°28'	61.2	NW	3	63	-	30.09	-	-	1	8	3	-	-	32.71	0.41
21	1145	6/12	36°12'	128°28'	60.2	NNE	4	67	-	30.07	-	-	2	8	4	-	-	32.87	0.42
22	1951	6/12	36°57'	128°16'	61.0	NNW	5	57	-	30.16	-	-	2	8	4	-	-	32.84	0.42
23	1138	6/13	37°31'	128°10'	60.8	NW	5	66	-	30.20	-	-	1	8	4	-	-	32.64	0.44
24	1950	6/13	36°52'	127°33'	59.2	NW	5	58	-	30.16	-	-	2	8	4	-	-	32.83	0.47
25	1141	6/14	36°19'	127°26'	60.0	NNW	5-6	64	-	30.18	-	-	3	8	4	-	-	32.78	0.44
26	1955	6/14	35°28'	126°40'	61.1	NW	5-6	58	-	30.10	-	-	7	7	4	-	-	32.82	0.45
27	1142	6/15	34°49'	126°04'	60.7	NNW	5	63	-	30.12	-	-	9	7	5	-	-	33.01	0.48
28	1946	6/15	35°28'	126°40'	60.5	NNW	5-6	56	-	30.08	-	-	4	7	5	-	-	33.25	0.42
29	1226	6/16	33°38'	124°58'	60.5	NW	5	64	-	30.11	-	-	4	7	5	-	-	33.31	0.36
30	1945	6/16	33°02'	124°27'	61.3	NW	5+	58	-	30.09	-	-	5	7	5	-	-	33.28	0.38

Table 3.--Summary of observations at bathythermograph lowerings, N. B. Scofield cruise 59S4 - con.

Ser. No.	Time, (GCT)	Date, 1959	Latitude N.	Longitude W.	Bkt. temp., (°F.)	Wind		Air temp.		Barometer, (mb.)	Weather	Clouds		Visibility	Sea	Swell		Surf. sal., (‰)	Surf. PO_4-P, μg·at./l.
						Dir., (°T.)	Force, (kn.)	Dry bulb, (°F.)	Wet bulb, (°F.)			Type	Cover			Dir. (°T.)	Amt.		
31	1140	6/17	32°25'	123°56'	61.0	NW	5+	64	-	30.05	-	-	1	7	5	-	-	33.25	1.59
32	1940	6/17	32°53'	124°04'	59.8	NW	5+	58	-	29.99	-	-	5	6	5	-	-	32.94	0.50
33	1140	6/18	33°18'	124°09'	59.2	NW	5	65	-	30.02	-	-	9	7-8	5	-	-	33.05	0.44
34	1944	6/18	33°54'	124°21'	60.3	NW	5	59	-	30.00	-	-	9	7-8	5	-	-	33.01	0.48
35	1139	6/19	34°13'	124°22'	60.3	NW	5-6	65	-	30.04	-	-	9	7	5	-	-	32.85	0.39
36	1941	6/19	34°47'	124°36'	60.0	NW	6-7	57	-	30.03	-	-	7	7	5	-	-	32.81	0.41
37	1137	6/20	34°11'	124°40'	60.2	NW	6-7	63	-	30.05	-	-	1	7	6	-	-	32.91	0.42
38	1939	6/20	35°48'	124°24'	58.8	NW	6-7	58	-	29.99	-	-	2	7	6	-	-	32.87	0.46
39	1115	6/21	35°28'	124°05'	59.0	NW	6	59	-	29.96	-	-	1	7	6	-	-	33.04	0.35
40	2002	6/21	34°39'	123°19'	59.4	NW	6	68	-	29.90	-	-	2	7	5	-	-	33.40	0.60
41	1137	6/22	33°48'	123°06'	57.6	NW	5	61	-	29.90	-	-	1	8	4	-	-	33.25	0.47
42	1937	6/22	33°00'	122°52'	60.8	NW	5	58	-	29.80	-	-	1	7	4	-	-	33.36	0.39
43	0535	6/23	32°15'	122°45'	61.1	NW	4-5	59	-	28.80	-	-	1	8	4	-	-	33.30	0.59
44	1137	6/23	32°51'	122°37'	60.7	NW	4-5	63	-	29.92	-	-	1	8	4	-	-	33.45	0.52
45	1925	6/23	33°34'	122°26'	59.2	NW	6	58	-	28.89	-	-	2	7	5	-	-	-	-
46	0920	6/24	32°25'	121°14'	61.8	NW	7	62	-	29.94	-	-	9	7	5	-	-	-	-

Table 4.--Oceanographic observations, Hugh M. Smith cruise 52

Sta. No.	Time (GCT)	Date, 1959	Latitude N.	Longitude W.	Salinity (°/oo)	PO_4 (ug.at./l.)	Photometer 50%	Photometer 10%	Photometer 5%	Photometer 1%	Average light (foot candles)	Secchi disk (m.)	Forel color (scale)	Productivity[1/]	Zooplankton (g./1,000 $m.^3$)	Night-light counts
1	2205	4/29	23°12'	155°27'	35.005	0.34	25.4	61.6	93.4	116.8	-	20.2	1	0.065	-	-
2	0615	4/30	23°51'	154°39'	35.000	-	-	-	-	-	-	-	-	-	74.1	-
3	2200	4/30	25°23'	152°43'	34.760	0.81	20.5	58.0	89.0	127.0	-	27.4	1	0.133	-	-
4	0605	5/1	26°12'	151°48'	34.974	-	-	-	-	-	-	-	-	0.195	-	-
5	2205	5/1	27°49'	149°47'	35.153	0.49	2.5	48.0	79.0	134.5	-	27.4	1	0.065	66.5	-
6	0605	5/2	28°40'	148°47'	35.110	-	-	-	-	-	-	-	-	-	-	-
7	2210	5/2	30°21'	146°41'	34.974	0.32	-	-	-	-	-	27.4	1	0.219	29.4	-
8	0537	5/3	31°06'	145°41'	34.610	-	-	-	-	-	-	-	-	-	-	-
9	2100	5/3	32°37'	143°43'	34.427	0.20	7.5	41.0	77.5	137.0	-	27.4	1	-0.049	54.7	-
10	0532	5/4	33°16'	142°49'	34.117	-	-	-	-	-	-	-	-	0.121	-	-
11	2100	5/4	34°23'	141°13'	34.063	1.65	26.0	50.0	83.1	128.3	6750	25.6	1	0.007	16.7	-
12	0301	5/5	34°48'	140°41'	34.041	0.20	-	-	-	-	-	-	-	0.149	-	-
13	2100	5/5	35°17'	140°13'	33.902	0.33	-	73.2	93.5	130.6	7500	27.4	1	0.058	-	1 squid
14	0530	5/6	35°53'	139°14'	33.753	-	-	-	-	-	-	-	-	-	-	-
15	1657	5/6	36°48'	138°00'	33.726	0.42	45.0	76.2	81.8	115.0	7500	31.0	1	0.089	33.7	-
16	0530	5/7	37°12'	137°31'	35.665	-	-	-	-	-	-	-	-	0.022	-	-
17	2100	5/7	38°28'	135°50'	33.171	0.44	11.0	42.8	65.5	128.7	4050	23.8	1	0.053	33.0	-
18	0301	5/7	38°48'	135°06'	33.214	0.55	-	-	-	-	-	-	-	-	-	-
18	1630	5/8	38°48'	135°06'	-	-	-	24.8	58.3	105.0	2000	20.2	1	0.042	-	30-100 saury, a few squid
19	2100	5/8	38°28'	134°39'	33.118	0.36	-	53.6	70.4	100.4	4400	21.9	1	-	-	-
20	0530	5/9	37°47'	133°46'	-	-	-	-	-	-	-	-	-	-	103.0	-
21	2100	5/9	36°40'	132°21'	33.616	0.51	5.6	44.9	75.4	129.9	2923	21.9	1	0.062	-	-
22	0307	5/10	36°39'	132°24'	-	0.34	-	-	-	-	-	-	-	-	-	30-100 saury, 1 squid
22	1615	5/10	36°39'	132°24'	-	-	-	46.3	73.1	121.5	1815	21.9	1	-	-	-
22a	2000	5/10	36°21'	131°51'	-	-	-	-	-	-	-	-	-	0.079	-	-
23	0505	5/11	35°38'	131°05'	33.216	-	-	-	-	-	-	-	-	-	25.9	-
24	2000	5/11	34°32'	129°32'	33.200	0.51	-	31.9	53.4	94.7	7000	29.3	1	0.112	-	-
25	0431	5/12	33°54'	128°45'	33.193	-	-	-	-	-	-	-	-	0.033	33.7	-
25a	2000	5/12	34°36'	126°54'	-	-	-	-	-	-	-	-	-	-	-	-
25b	1900	5/13	37°24'	123°02'	-	-	-	-	-	-	-	-	-	0.066	-	-
26	1600	5/17	33°19'	128°00'	33.278	0.45	23.6	29.0	66.4	104.7	7500	27.4	1	1.854	-	-
27	0430	5/17	32°04'	127°24'	-	-	-	-	-	-	-	-	-	0.108	-	-
28	2000	5/18	31°26'	125°32'	33.693	0.22	-	54.6	83.2	118.2	8400	31.1	1	0.063	10.3	-
29	0430	5/19	30°48'	125°52'	-	-	-	-	-	-	-	-	-	0.017	-	-
29a	2000	5/19	29°25'	124°02'	-	-	-	-	-	-	-	-	-	-	18.4	-
29b	2000	5/20	29°39'	123°56'	-	-	-	-	-	-	-	-	-	0.119	-	-
30	1600	5/21	28°53'	123°24'	34.099	0.32	2.0	41.3	74.3	125.5	4283	25.6	1	0.047	-	-
														0.067	-	-
														0.097	-	-

1/ Productivity values are in milligrams of carbon converted from inorganic to organic carbon per hour per meter of water. Where two values of productivity ar given the replicate light bottle values differed by more than 20 percent of the lower value. Negative numbers mean essentially no productivity measured, as do other numbers in the third decimal place.

Table 4.--Oceanographic observations, Hugh M. Smith cruise 52 - con.

Sta. No.	Time (GCT)	Date, 1959	Latitude N.	Longitude W.	Salinity (°/oo)	PO_4 (ug.at./l.)	Photometer 50%	Photometer 10%	Photometer 5%	Photometer 1%	Average light (foot candles)	Secchi disk (m.)	Forel color (scale)	Productivity[1]	Zooplankton (g./1,000 m.^{3})	Night-light counts
31	0427	5/22	28°27'	123°04'	-	-	-	-	-	-	-	-	-	-	18.7	-
32	1600	5/22	27°21'	122°07'	34.281	0.26	5.0	42.8	78.9	130.9	7300	23.8	1	0.063	-	-
33	0200	5/23	26°59'	121°59'	34.155	0.28	-	-	-	-	-	-	-	-0.033	-	1-5
33	1600	5/23	26°59'	121°59'	-	-	8.9	22.0	78.8	129.0	4312	27.4	1	-0.010	-	-
34	2030	5/23	26°51'	121°32'	34.060	0.26	13.4	55.8	81.7	129.2	7550	32.9	1	0.166	-	-
35	0205	5/24	27°00'	120°56'	33.974	0.27	-	-	-	-	-	-	-	-	-	1-5 unid. sm. fish, 7 squid
36	2000	5/24	27°00'	120°18'	34.060	0.26	12.0	47.7	75.2	126.4	4500	25.6	1	0.057	-	-
37	0202	5/25	27°00'	119°31'	33.974	0.29	-	-	-	-	-	-	-	0.121	-	30-100 saury
38	2000	5/25	27°04'	118°53'	34.050	0.27	0.5	47.0	64.8	110.4	7050	27.4	1	0.076	-	-
39	0400	5/26	27°33'	118°23'	-	-	-	-	-	-	-	-	-	-	16.6	-
40	2000	5/26	29°52'	117°58'	33.609	0.32	3.1	36.7	63.4	112.7	2715	18.3	1	0.095	-	-
41	0400	5/27	30°56'	117°47'	-	-	-	-	-	-	-	-	-	-	73.4	-
42	1830	5/29	San Diego harbor		-	-	-	-	-	-	-	-	-	-	-	-
43	2000	5/30	32°30'	117°46'	33.703	0.32	10.5	27.8	38.9	49.2	7950	18.3	2	0.228	-	-
44	0205	5/31	32°30'	118°20'	33.673	0.34	-	-	-	-	-	-	-	-	-	About 1000 small anchovie
44a	1515	5/31	32°33'	118°26'	33.693	0.37	-	-	-	-	-	-	-	0.694	-	-
45	2000	5/31	32°33'	119°07'	33.579	0.48	2.0	14.5	29.0	75.4	3450	14.6	4	0.887	-	-
46	0200	6/1	32°08'	119°35'	33.480	-	-	-	-	-	-	-	-	-	-	Nothing under light
46a	1515	6/1	32°05'	119°28'	-	0.86	-	-	-	-	-	-	-	0.166	-	-
47	2000	6/1	32°04'	120°05'	33.464	0.41	1.1	24.1	41.6	83.0	2760	16.4	2	0.065	-	-
48	0431	6/2	32°07'	121°19'	-	-	-	-	-	-	-	-	-	0.338	67.5	-
49	2000	6/2	31°49'	123°34'	33.543	0.37	2.4	37.0	71.9	124.4	3360	23.7	1	0.044	-	-
50	0432	6/3	31°08'	124°22'	-	-	-	-	-	-	-	-	-	-	23.0	-
51	2000	6/3	31°03'	124°54'	33.586	0.38	16.1	53.7	80.6	123.5	8100	34.7	1	0.063	-	-
52	0430	6/4	31°27'	124°56'	-	-	-	-	-	-	-	-	-	-	39.1	-
53	2000	6/4	30°39'	124°18'	33.475	0.46	5.2	23.7	76.5	125.5	6000	31.2	1	0.035	-	-
54	0201	6/5	30°28'	123°35'	33.537	0.37	-	-	-	-	-	-	-	0.075	-	Nothing under light
55	2000	6/5	30°20'	123°05'	33.693	0.35	6.0	43.2	70.9	101.8	3450	27.4	1	0.072	-	-
56	0430	6/6	30°11'	122°07'	-	-	-	-	-	-	-	-	-	-	10.3	-
57	2000	6/6	29°59'	120°57'	33.548	0.39	-	48.8	67.6	-	7440	25.6	1	0.043	-	-
58	0430	6/7	29°51'	120°27'	-	-	-	-	-	-	-	-	-	-	13.1	-
59	1958	6/7	29°48'	118°37'	33.486	0.36	-	-	-	-	-	-	-	0.083	-	-
60	1644	6/8	29°28'	117°55'	33.811	0.31	-	-	-	-	-	-	-	0.176 0.099	-	-

Table 4.--Oceanographic observations, Hugh M. Smith cruise 52 - con.

Sta. No.	Time (GCT)	Date, 1959	Latitude N.	Longitude W.	Salinity (°/oo)	PO_4 (ug.at./l.)	Photometer 50%	Photometer 10%	Photometer 5%	Photometer 1%	Average light (foot candles)	Secchi disk (m.)	Forel color (scale)	Productivity[1/]	Zooplankton (g./1,000 m.^{3})	Night-light counts
61	0430	6/9	29°09'	117°53'	-	-	-	-	-	-	-	-	-	-	11.5	-
62	2000	6/9	28°57'	118°01'	33.842	0.35	4.0	46.3	62.1	90.6	8400	29.3	1	0.079	-	-
63	0245	6/10	28°50'	117°57'	33.805	0.33	-	-	-	-	-	-	-	-	-	Nothing under light
64	2000	6/10	28°09'	117°18'	33.832	0.94	1.2	40.5	61.2	107.5	3300	23.8	1	0.006	-	-
65	0205	6/11	29°23'	117°00'	33.690	0.42	-	-	-	-	-	-	-	-	-	Occasional saury, 1 Myctophid
66	2000	6/11	28°57'	117°15'	33.726	0.49	7.7	38.4	71.1	113.6	5070	29.3	1	0.017	-	-
67	0403	6/12	28°37'	118°07'	-	-	-	-	-	-	-	-	-	-	-	-
68	2000	6/12	28°14'	119°31'	33.891	-	7.2	34.8	63.0	112.0	4520	-	-	0.096	-	-
69	0428	6/13	28°04'	120°08'	-	-	-	-	-	-	-	-	-	-	12.6	-
70	1915	6/13	27°33'	121°45'	34.085	0.31	5.1	45.9	79.2	130.0	3000	31.2	1	-0.091	-	-
71	0210	6/14	27°33'	122°15'	33.117	0.39	-	-	-	-	-	-	-	-	-	Nothing under light
72	2000	6/14	27°42'	122°00'	33.954	0.31	5.7	54.0	81.6	100.3	2780	34.7	1	-0.073 -0.098	-	-
73	0430	6/15	28°23'	121°39'	-	-	-	-	-	-	-	-	-	-	12.7	-
74	2005	6/15	29°55'	120°20'	33.938	0.29	-	-	-	-	-	-	-	-0.068 -0.174	-	-
75	0435	6/16	29°55'	120°20'	-	-	-	-	-	-	-	-	-	-	17.6	-
76	1925	6/16	30°48'	119°16'	33.775	0.21	-	-	-	-	-	-	-	0.555 0.112	-	-
77	2138	6/17	30°47'	119°10'	33.798	0.24	-	-	-	-	-	-	-	0.291 0.154	-	-
78	0430	6/18	31°20'	119°14'	-	-	-	-	-	-	-	-	-	-	48.9	-
79	2000	6/18	31°38'	118°15'	33.950	0.28	4.5	17.2	29.0	63.0	4620	16.4	4	0.871	-	100-500 sm. unid. fish
80	0203	6/19	31°59'	117°46'	33.722	0.44	-	-	-	-	-	-	-	0.822	-	-

Table 5.--Oceanographic observations, N. B. Scofield cruise 59S4

Sta. No.	Time (GCT)	Date, 1959	Latitude N.	Longitude W.	Salinity (°/oo)	PO_4 (ug.at./l.)	Productivity[1/]	Plankton (g./1,000 m.^{3})
1	0235	6/4	34°21'	120°41'	33.61	0.80	-	-
1	0305	6/4	34°21'	120°41'	-	-	-	23.3
2	2050	6/4	34°35'	121°44'	33.22	0.44	-	-
3	2155	6/4	34°47'	122°19'	33.29	1.23	-	-
4	0340	6/5	34°53'	122°40'	33.06	0.55	-	-
5	2035	6/5	35°12'	123°21'	33.16	0.48	-	-
6	0400	6/6	35°23'	124°14'	-	0.65	-	-
7	1223	6/6	35°45'	124°52'	32.86	0.96	-	-
8	0328	6/7	36°25'	125°55'	32.44	0.50	-	-
9	1402	6/7	35°46'	125°59'	32.81	0.44	-	-
10	1914	6/7	34°50'	126°06'	32.99	0.35	-	-
10	1930	6/7	34°50'	126°06'	-	-	0.078	34.9
11	0342	6/8	34°06'	126°27'	32.82	0.51	-	-
11	0403	6/8	34°06'	126°27'	-	-	-	-
12	1937	6/8	33°10'	126°48'	33.16	0.42	-	-
12	1947	6/8	33°10'	126°49'	-	-	0.082	56.3
13	0345	6/9	31°46'	127°18'	33.54	0.31	-	-
13	0358	6/9	31°46'	127°18'	-	-	-	-
14	1500	6/9	32°12'	127°43'	33.63	0.32	-	-
15	1937	6/9	32°24'	128°04'	33.60	0.28	-	-
15	1951	6/9	32°24'	128°04'	-	-	0.150 0.086	-
16	0350	6/10	32°28'	128°14'	33.25	0.35	-	-
17	1931	6/10	34°19'	128°18'	33.13	0.35	-	-
17	1945	6/10	34°19'	128°18'	-	-	0.095 0.138	-
18[2/]	0349	6/11	35°02'	128°27'	33.03	0.38	-	-
19	1924	6/11	35°35'	128°27'	36.52	0.24	-	-
19	1942	6/11	35°35'	128°27'	-	-	0.114	-
20	0304	6/12	36°12'	128°28'	32.71	0.41	-	-
21	1945	6/12	36°57'	128°16'	32.87	0.42	-	-
21	1958	6/12	36°57'	128°16'	-	-	0.212	-
22	0350	6/13	37°29'	128°16'	-	-	-	-
22	0351	6/13	37°29'	128°16'	32.84	0.42	-	-
22	1938	6/13	37°29'	128°16'	-	-	0.019	-
22	1950	6/13	37°29'	128°18'	-	-	0.051	-
23	0350	6/14	36°52'	127°33'	32.64	0.44	-	-
23	0400	6/14	36°52'	127°35'	-	-	-	57.1
24	1941	6/14	36°19'	127°26'	32.83	0.47	-	-
24	1955	6/14	36°19'	127°26'	-	-	0.124 0.236	-
25	0355	6/15	35°28'	126°40'	32.78	0.44	-	-
26	1942	6/15	34°49'	126°04'	33.82	0.45	-	-
26	1955	6/15	34°49'	126°04'	-	-	0.201	-
27	0346	6/16	34°09'	125°32'	33.01	0.48	-	-
28	2026	6/16	33°38'	124°58'	33.25	0.42	-	-
29	0345	6/17	33°02'	124°27'	33.31	0.36	-	-
30	1940	6/17	32°25'	123°56'	33.28	0.38	-	-
30	1954	6/17	32°25'	123°56'	-	-	0.107	-

1/ Productivity values are in milligrams of carbon converted from inorganic to organic carbon per hour per meter or water. Where two values of productivity are given the replicate light bottle values differed by more than 20 percent of the lower value. Negative numbers mean essentially no productivity measured, as do other numbers in the third decimal place.

2/ Miscellaneous data - One Secchi disc reading was taken at Station 18 (31 meters).

Table 5.--Oceanographic observations, N. B. Scofield cruise 59S4 - con.

Sta. No.	Time (GCT)	Date 1959	Latitude N.	Longitude W.	Salinity (°/oo)	PO_4 (ug.at./l.)	Productivity[1/]	Plankton (g./1,000 m.^{3})
31	0340	6/18	32°53'	124°04'	33.25	1.59	-	-
32	1940	6/18	33°18'	124°09'	32.94	0.50	-	-
32	1950	6/18	33°18'	124°09'	-	-	0.078	-
							0.267	
33	0344	6/19	33°53'	124°21'	33.05	0.44	-	-
34	1939	6/19	34°13'	124°22'	33.01	0.48	-	-
34	1952	6/19	34°13'	124°22'	-	-	0.083	-
							0.132	
35	0341	6/20	34°47'	124°36'	32.85	0.39	-	-
36	1937	6/20	35°11'	124°40'	32.81	0.41	-	-
36	1955	6/20	35°11'	124°40'	-	-	-0.005	-
							0.065	
37	0339	6/21	35°48'	124°24'	32.91	0.42	-	-
38	1915	6/21	35°28'	124°05'	32.87	0.46	-	-
38	1926	6/21	35°28'	124°05'	-	-	0.472	-
39	0402	6/22	34°39'	123°19'	33.04	0.35	-	-
40	1937	6/22	33°48'	123°06'	33.40	0.60	-	-
40	1949	6/22	33°48'	123°06'	-	-	2.221	-
							3.665	
41	0337	6/23	33°00'	122°52'	33.25	0.47	-	-
41	0349	6/23	33°00'	122°52'	-	-	-	601.9
42	1335	6/23	32°15'	122°45'	33.36	0.39	-	-
43	1937	6/23	32°51'	122°37'	33.30	0.59	-	-
43	1949	6/23	32°51'	122°37'	-	-	-	-
44	0325	6/24	33°34'	121°26'	33.45	0.52	-	-
45	1720	6/24	32°25'	121°14'	-	0.38	-	-

Table 6.--Sightings of tuna schools, birds, and aquatic mammals, Hugh M. Smith cruise 52

Date, 1959	Noon position		Flocks				Scattered birds										Tuna schools	Aquatic mammals		
			Number of birds			Species comprised														
	Latitude N.	Longitude W.	<10	11-50	>50	Petrel or shearwater	Tern	Tropic-bird	Frigate bird	Petrel or shearwater	Storm petrel	Albatross	Bos'un bird	Sea gull	Snipe		Porpoise	Whale	Seal
4/29	23°13'	155°28'	-	-	-	-	5	1	2	36	7	1	1	-	-	-	-	-	-
4/30	25°23'	152°43'	-	-	-	-	10	3	-	16	10	7	1	-	-	-	-	-	-
5/1	27°49'	149°47'	-	-	-	-	10	4	-	17	21	14	-	-	-	-	-	-	-
5/2	30°21'	146°42'	-	-	-	-	-	2	-	5	6	12	-	-	-	-	-	-	-
5/3	32°37'	143°44'	-	-	-	-	-	-	-	1	17	3	-	-	-	-	-	-	-
5/4	34°23'	141°14'	-	-	-	-	-	-	-	9	4	6	-	-	-	-	-	-	-
5/5	35°17'	140°13'	-	-	-	-	-	-	-	4	9	2	-	-	-	-	15	12	-
5/6	36°49'	138°00'	-	-	-	-	-	2	-	3	2	6	-	-	-	-	-	-	-
5/7	38°28'	135°51'	-	-	-	-	-	-	-	9	16	6	-	-	-	-	100	-	-
5/8	38°28'	134°39'	-	-	-	-	-	-	-	20	19	9	-	-	-	-	-	-	-
5/9	36°40'	132°21'	-	-	-	-	-	3	-	17	14	7	1	-	-	-	20	-	-
5/10	36°18'	131°49'	-	-	-	-	-	-	-	5	3	15	-	-	-	-	-	-	-
5/11	34°33'	129°32'	-	-	-	-	-	-	-	10	6	24	-	-	-	-	-	-	-
5/12	34°37'	126°55'	-	-	-	-	-	-	-	41	13	5	-	-	55	-	-	-	1
5/13	37°24'	123°03'	-	-	1	800	-	-	-	61	-	2	-	8	18	-	20	-	37
5/15	37°24'	123°13'	-	-	-	-	2	-	-	64	1	1	20	18	-	-	-	2	-
5/16	35°45'	126°03'	-	-	-	-	9	-	-	27	5	12	-	-	-	-	-	2	-
5/17	33°20'	127°58'	-	-	-	-	-	-	-	5	7	15	-	-	-	-	-	-	-
5/18	31°27'	125°33'	-	-	-	-	-	-	-	3	5	23	-	-	-	-	-	-	-
5/19	29°25'	124°03'	-	-	-	-	-	-	-	21	7	10	-	-	-	-	-	-	-
5/20	29°39'	123°56'	-	-	-	-	-	1	-	9	5	4	-	-	-	-	-	-	-
5/21	28°53'	123°24'	-	-	-	-	-	-	-	31	14	6	-	-	-	-	-	-	-
5/22	27°21'	122°08'	-	-	-	-	-	1	-	-	-	3	-	-	-	-	-	-	-
5/23	26°52'	121°35'	-	-	-	-	1	2	-	9	1	1	-	1	-	-	-	-	-
5/24	27°00'	120°19'	-	-	-	-	-	2	-	22	11	-	-	-	-	-	-	-	-
5/25	27°04'	118°53'	-	-	-	-	-	-	-	66	8	-	-	-	-	-	-	-	-
5/26	29°52'	117°59'	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-
5/27	San Diego harbor																		
5/30	32°31'	117°46'	-	1	-	30	13	-	-	18	44	3	-	74	-	-	15	-	-
5/31	32°33'	119°07'	-	-	-	-	18	-	-	58	53	10	-	-	-	-	15	1	-
6/1	32°04'	120°05'	-	-	-	-	-	-	-	-	2	67	1	-	-	-	-	-	-
6/2	31°50'	123°34'	-	-	-	-	-	-	-	3	27	3	-	-	-	-	-	-	-
6/3	31°04'	124°54'	-	-	-	-	2	-	-	2	-	2	-	-	-	-	-	-	-
6/4	30°39'	124°18'	-	-	-	-	-	1	-	9	11	2	-	-	-	-	-	-	-
6/5	30°20'	123°05'	-	-	-	-	-	-	-	9	-	1	-	-	-	-	-	-	-
6/6	29°60'	120°58'	-	-	-	-	-	-	-	9	6	1	-	-	-	-	-	-	-
6/7	29°42'	118°37'	-	1	-	30	-	1	-	19	19	4	-	-	-	1	-	-	-
6/8	29°38'	117°55'	-	-	-	-	-	-	-	27	47	1	-	-	-	-	-	-	-
6/9	28°57'	118°01'	-	-	-	-	-	-	-	60	21	1	-	23	-	-	-	2	-
6/10	29°10'	117°18'	1	1	-	13 10	-	-	-	33	73	-	-	1	-	-	1000	3	
6/11	28°57'	117°15'	-	-	1	500	-	-	-	43	41	2	-	1	-	-	1100+	12	-
6/12	28°14'	119°31'	-	-	-	-	-	-	-	14	45	1	-	1	-	-	-	-	-
6/13	27°34'	121°45'	-	1	-	20	-	-	-	5	2	14	-	-	-	-	-	-	-
6/14	27°43'	122°00'	-	-	-	-	-	-	-	51	13	4	-	-	-	-	-	-	-
6/15	29°24'	120°54'	-	-	-	-	-	-	-	8	8	4	-	-	-	-	-	-	-
6/16	30°48'	119°13'	-	-	-	-	-	-	-	11	22	4	-	-	-	-	-	-	-
6/17	30°45'	119°11'	-	-	-	-	-	-	-	3	29	7	-	-	-	-	-	-	-
6/18	31°38'	118°15'	-	-	-	-	-	-	-	15	42	8	-	1	-	-	60+	2	-
6/19	32°34'	117°25'	-	-	1	120	7	-	-	18	4	18	-	16	-	-	-	-	-

Table 7.--Sightings of birds and aquatic mammals, N. B. Scofield cruise 59S4

Date, 1959	Sighted within		Observations
	Latitude N.	Longitude W.	
6/4	34°48' 34°53'	122°19' 122°40'	terns, storm petrels, shearwaters abundant. 1 albatross
6/5	35°12' 35°23'	123°21' 124°12'	no birds or mammals sighted
6/6	35°23'	124°14'	1-6 albatross
6/7	35°46' 34°50'	125°59' 126°06'	1-6 albatross
6/8	34°06' 33°10'	126°27' 126°49'	1-6 albatross
6/9	31°46' 32°24'	127°19' 128°04'	1-6 albatross
6/10	34°19'	128°18'	1-6 albatross
6/11	35°35'	128°28'	1-6 albatross, several whales
6/12	36°57'	128°16'	1-6 albatross, 1 storm petrel
6/13	36°52'	127°33'	several storm petrels
6/14	35°28'	126°40'	several Beal's petrels
6/15	34°09'	125°32'	no birds or mammals sighted
6/16	33°02'	124°27'	1-6 albatross
6/17	32°53'	124°04'	1-6 albatross
6/18	33°54'	124°21'	1-6 albatross
6/19	34°47'	124°36'	3 albatross
6/21	35°48'	124°24'	1-6 albatross, 2 whales
6/22	34°39'	123°19'	scattered Beal's petrels, 6 albatross
6/23	33°00'	122°52'	1-6 albatross
6/24	33°34' 32°25'	122°26' 121°14'	2 albatross